Michigan Department of Environmental Quality
Air Quality Division

STATE IMPLEMENTATION PLAN SUBMITTAL

FOR

FINE PARTICULATE MATTER ($PM_{2.5}$)

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Air Quality Division
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List of Acronyms

AEO	Annual Emissions Output
AMS	Area Mobile Source
AQD	Air Quality Division
BOF	Basic Oxygen Furnace
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Division
CAMR	Clean Air Mercury Rule
CEM	Continuous Emissions Monitoring
CERR	Consolidated Emissions Reporting Rule
CIBO	Council of Industrial Boiler Owners
CMAQ	Congestion Mitigation Air Quality
CMB	Chemical Mass Balance
D.C. Circuit	U.S. Court of Appeals for the District of Columbia Circuit
DEQ	Department of Environmental Quality
DLEG	Department of Labor and Economic Growth
DOJ	Department of Justice
E 7 Mi	East 7 Mile
EC	Elemental Carbon
EGU	Electric Generating Unit
EIA	Energy Information Agency
EIIP	Emissions Inventory Improvement Program
EPA	United States Environmental Protection Agency
ESP	Electrostatic Precipitator
FCCU	Fluid Catalytic Cracking Unit
FHWA	Federal Highway Administration
FRM	Federal Reference Method

HPMS	Highway Performance Monitoring System
ICI	Institutional, Commercial and Industrial
IPM	Integrated Planning Model
LADCO	Lake Michigan Area Director Consortium
LNB	Low NOx Burner
LMOP	Landfill Methane Outreach Program
LTO	Landing-Take Off
MAERS	Michigan Air Emissions Reporting System
MDA	Michigan Department of Agriculture
MDOT	Michigan Department of Transportation
MDEQ	Michigan Department of Environmental Quality
NACAA	National Association of Clean Air Agencies
NAAQS	National Ambient Air Quality Standard
NAICS	North American Industrial Classification System
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NEI	National Emissions Inventory
NH3	Ammonia
NIF	National Inventory Format
NMIM	National Mobile Inventory Model
NO	Nitrous oxide
NOx	Oxides of Nitrogen
NSR	New Source Review
NWS	National Weather Service
OC	Organic Carbon
OM	Organic Mass
PM	Particulate Matter
PM_{10}	Course Particulate Matter, <10 um in diameter
$PM_{2.5}$	Fine Particulate Matter, <2.5 um in diameter
PTI	Permit to Install
PMF	Positive Matrix Factorization
RACM	Reasonably Available Control Measures
RACT	Reasonably Available Control Technology
RFP	Reasonable Further Progress
RIC	Reciprocating Internal Combustion [engine]
ROP	Renewable Operating Permit
RPS	Renewable Portfolio Standards
RRF	Relative Reduction Factor
RTI	Research Triangle Institute
RVP	Reid Vapor Pressure
SCC	Source Classification Code
SCR	Selective Catalytic Reduction
SEMCOG	Southeast Michigan Council of Governments
SEMOS	Southeast Michigan Ozone Study
SEP	Supplemental Environmental Program
SIC	Standard Industrial Classification
SIP	State Implementation Plan

SNCR	Selective Non-catalytic Reduction
SO_2	Sulfur Dioxide
SOx	Oxides of Sulfur
STI	Sonoma Technology, Inc.
STN	Speciation Trends Network
SWHS	Southwestern High School (monitoring site)
tpy	Tons per Year
TSD	Technical Support Document
U.S. EPA	United States Environmental Protection Agency
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Carbon
WOE	Weight of Evidence

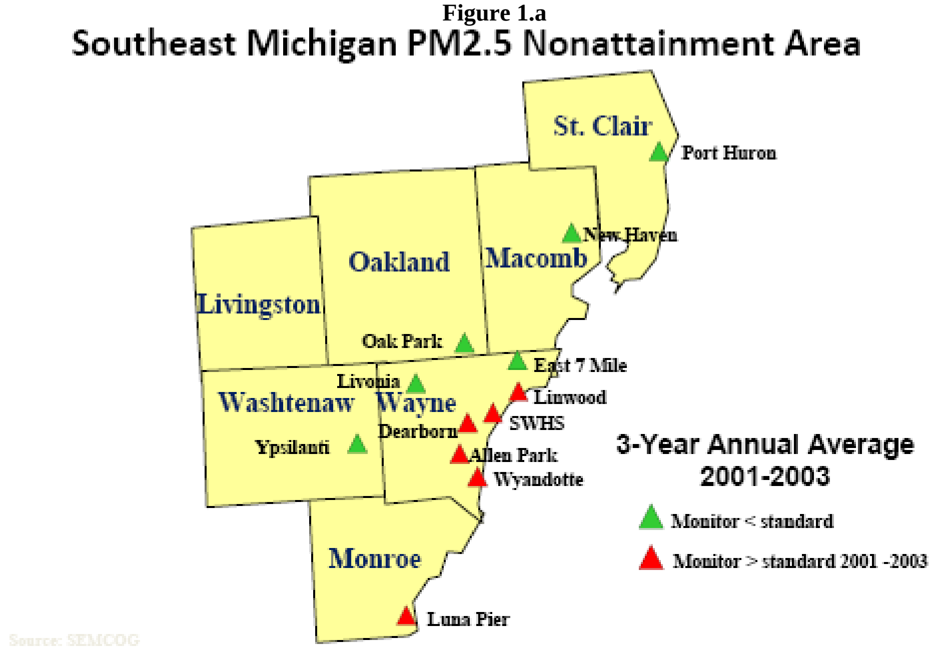
1. Executive Summary

The purpose of this summary is to synthesize three years of planning and analysis of fine particulate ($PM_{2.5}$) pollution in Southeast Michigan, and to demonstrate the connections between this analysis and the strategy for attaining the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$. While not technically required, this summary was prepared in the spirit of the Clean Air Act (CAA) and is intended for policymakers at all levels of government as well as the general public. Some technical information is included in this summary as necessary to communicate the policy that is the basis of the attainment strategy. However, the vast majority of the technical information is contained in other sections of this State Implementation Plan (SIP).

A new standard and an initial assessment

Over the last 30 years, the United States Environmental Protection Agency (EPA) adopted several air quality standards to protect the public from the health effects of particulate matter in our air. Each of these standards has been more stringent than its predecessor and the region has achieved compliance with each through regulatory programs to reduce emissions. The most recent NAAQS for fine particulate matter less than 2.5 microns or $PM_{2.5}$) was unique inasmuch as the region was in compliance with the daily standard, but some monitors measured violations of the annual standard. In short, half of the monitors were measuring attainment and half were recording violations of the annual standard (see Figure 1.a).

Figure 1.a



In examining the data between 2001 and 2003 we learned the following about locations measuring violations:

- Several monitors were closer to attaining the $PM_{2.5}$ NAAQS as compared to other monitors in the region.
- Higher levels of PM 2.5 were mostly confined to a fairly well-defined subsection of Wayne County.
- The exception was a site in southern Monroe County (Luna Pier).
- Higher levels at the Luna Pier site tracked with higher levels in the Toledo area (see Figure 1.b).
- Levels at the Dearborn monitor were clearly higher than the rest of the region and sites in other urban areas in the Midwest (see Figure 1.c).

Figure 1.b

3-Year Average PM2.5 Levels: Toledo and Luna Pier

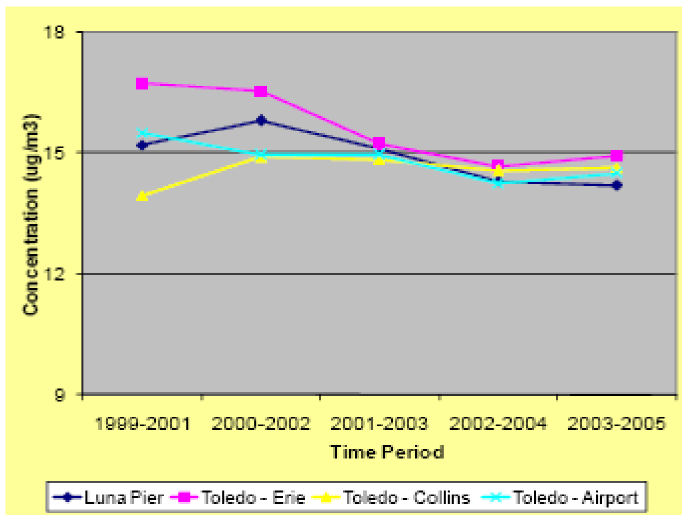
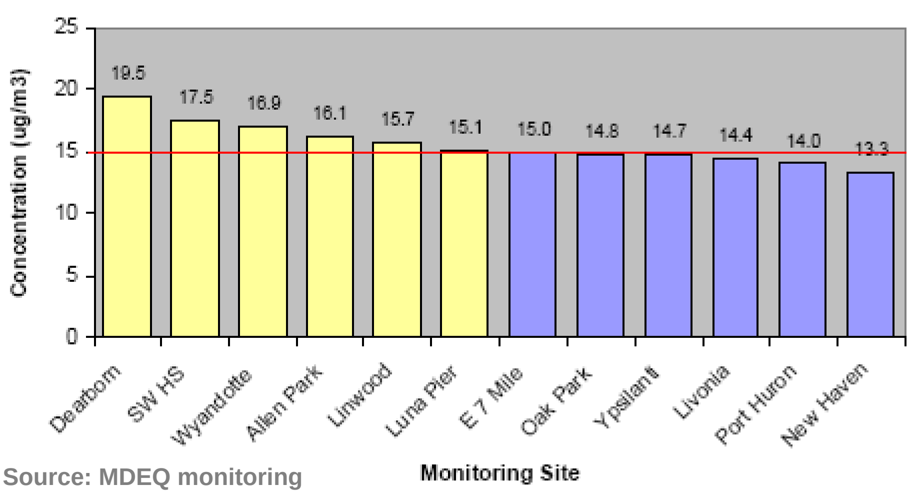


Figure 1.c

3-Year Average PM2.5 Concentrations
2001 – 2003



Source: MDEQ monitoring

A closer examination of monitoring data

After this initial screening and evaluation of monitoring data, we began a deeper probing of the data, seeking answers to key questions including:

- What are the similarities and differences between levels at violating monitors, particularly between Dearborn and the other sites?
- What is the composition of $PM_{2.5}$ at the different sites (fine particulate is made up of a wide variety of constituents)?
- What sources are impacting the different sites?

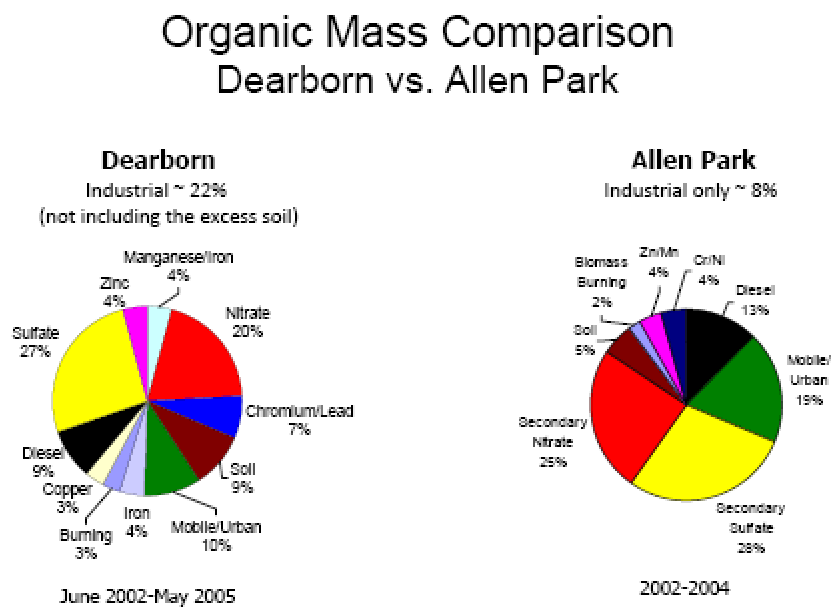
Numerous studies and analyses were conducted in pursuing answers to these questions. In some cases, different studies produced conflicting results. Nonetheless, we were able to converge on several more detailed findings supported by weighing the results of the different studies. (A detailed description is provided in the "Weight of Evidence" section.)

Additional monitoring data were available and provided further confirmation that monitors in southwest Detroit and east Dearborn were very distinct from the rest of the region. In addition, the data showed that levels at all sites measuring violations were improving.

Moreover, we were able to note significant differences in PM characteristics between Dearborn and other monitoring sites, particularly Allen Park, which is only six miles from Dearborn but is located in a less industrialized area. These identified differences provided invaluable information for isolating the causes of nonattainment as well as possible solutions.

In particular, it was clear that the Dearborn monitoring site was much more heavily influenced by industrial sources (see Figure 1.d), and levels of $PM_{2.5}$ had significantly higher amounts of soil and organic carbon (OC). Furthermore, the vast majority of the "soil" component at Dearborn was iron. Perhaps most significantly, reducing the levels of soil and organics at Dearborn to levels characteristic of sites measuring compliance would likely bring Dearborn into attainment.

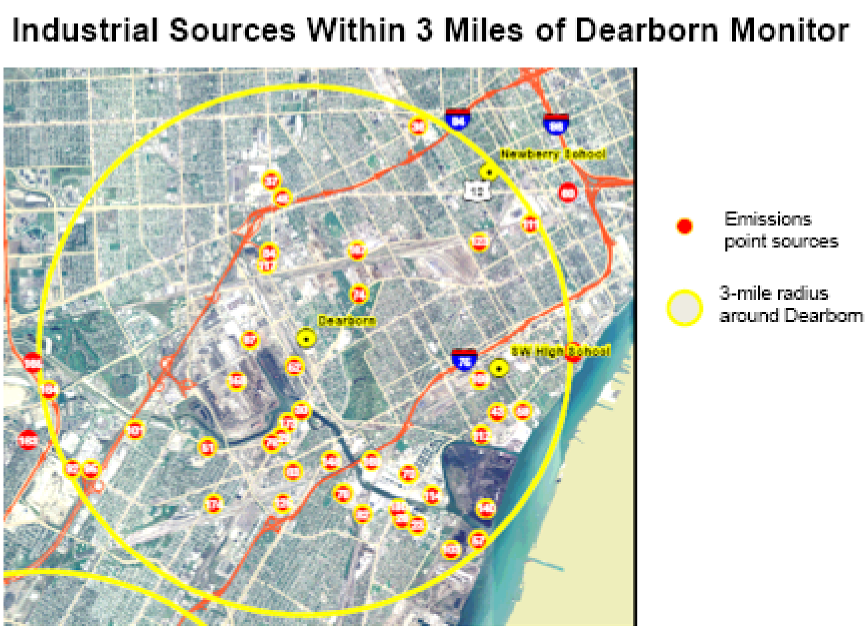
Figure 1.d



SOURCE: Sonoma Technologies Inc., 2006

Investigation of emission sources confirmed there was a complex array of sources within 3 miles of the Dearborn site (see Figure 1.e). These sources vary in their levels of emissions as well as the way in which those emissions are discharged to the air.

Figure 1.e



The significantly high proportion of iron in the soil component at Dearborn, as well as pollution roses for this iron component, pointing directly to the southwest, clearly showed that this excess was a result of nearby steel-making facility (see Figures 1.f-1.h).

Figure 1.f

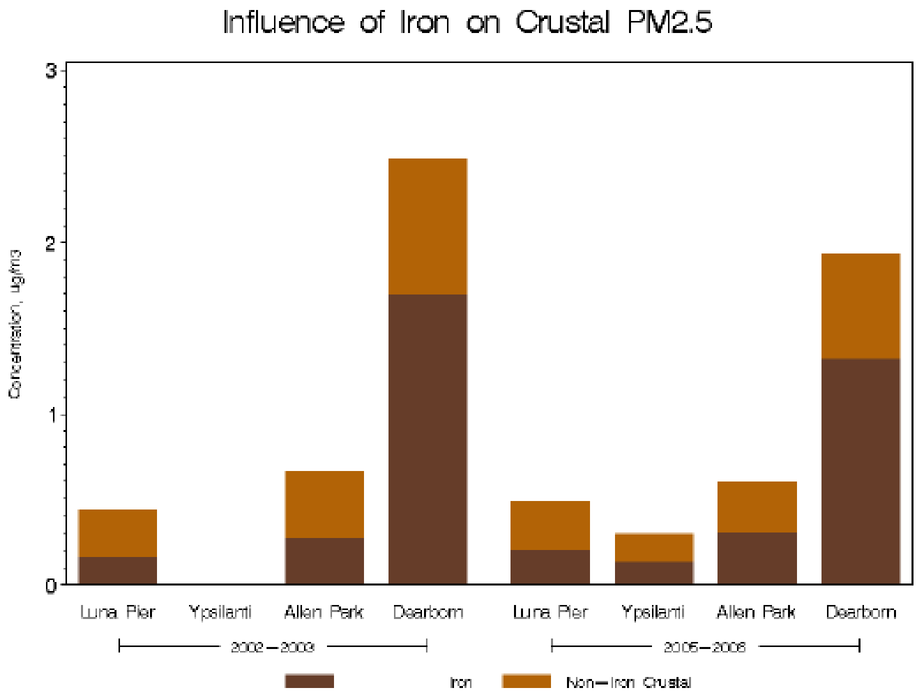
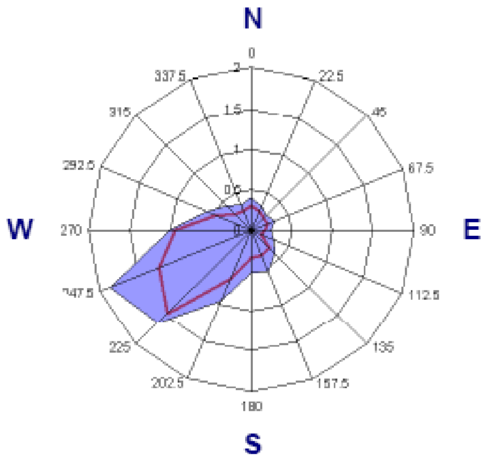


Figure 1.g

Location of Severstal
in Relation to Dearborn Monitor

Figure 1.h

Pollution Rose
for Iron at Dearborn
2003-2004



Finally, several evaluations were conducted assessing the degree to which sources in other parts of the region impacted particulate levels at the highest sites (Dearborn and SWHS). After looking at this issue from several perspectives, it was clear that these sources had little to no influence on *excess* levels at these problem sites (see Figures 1.i-1.k). And, to whatever extent they did contribute particulate to these problem sites that contribution was going to be reduced as a result of the numerous multistate emission reduction programs already being phased in. These controls come from a combination of industrial sources as well as motor vehicles and fuels.

Figure 1.i
Average $PM_{2.5}$ Concentration at Each Site When Winds Are From the Northeast

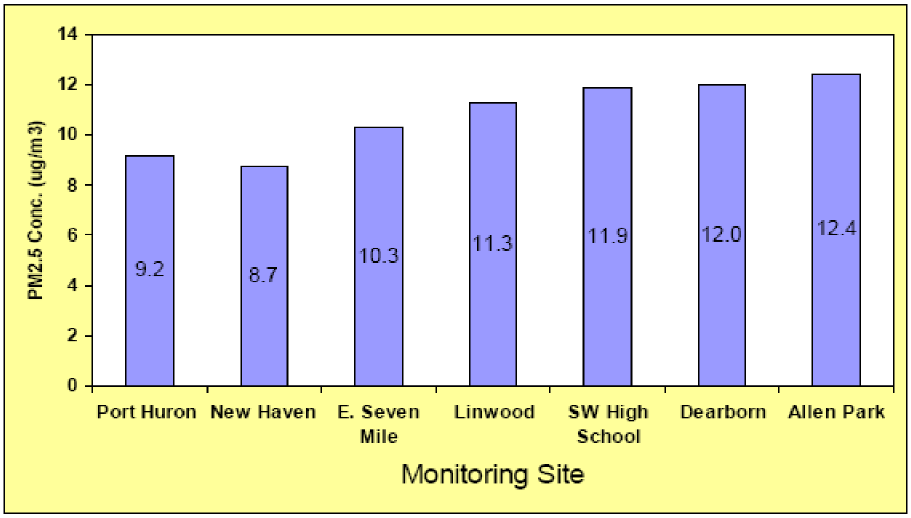


Figure 1.j
Average $PM_{2.5}$ Concentration at Each Site When Winds Are Form the Northwest

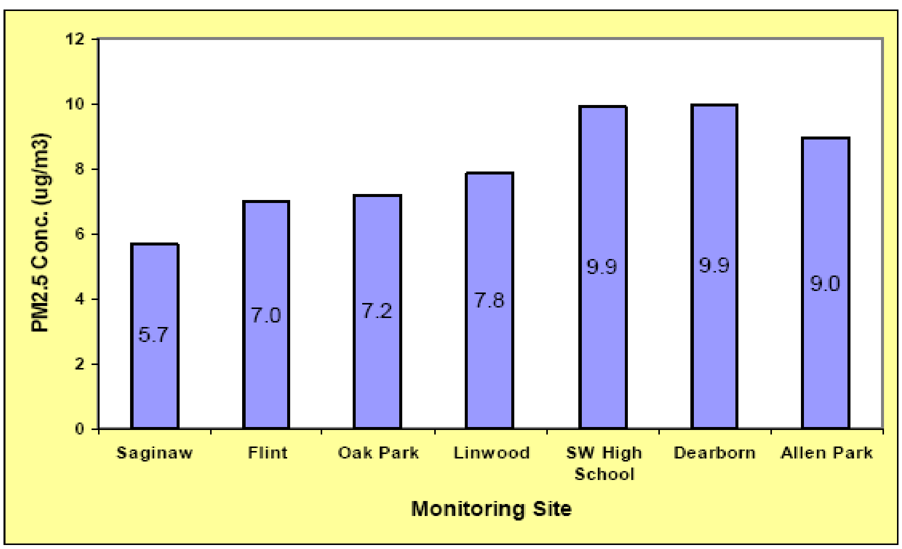
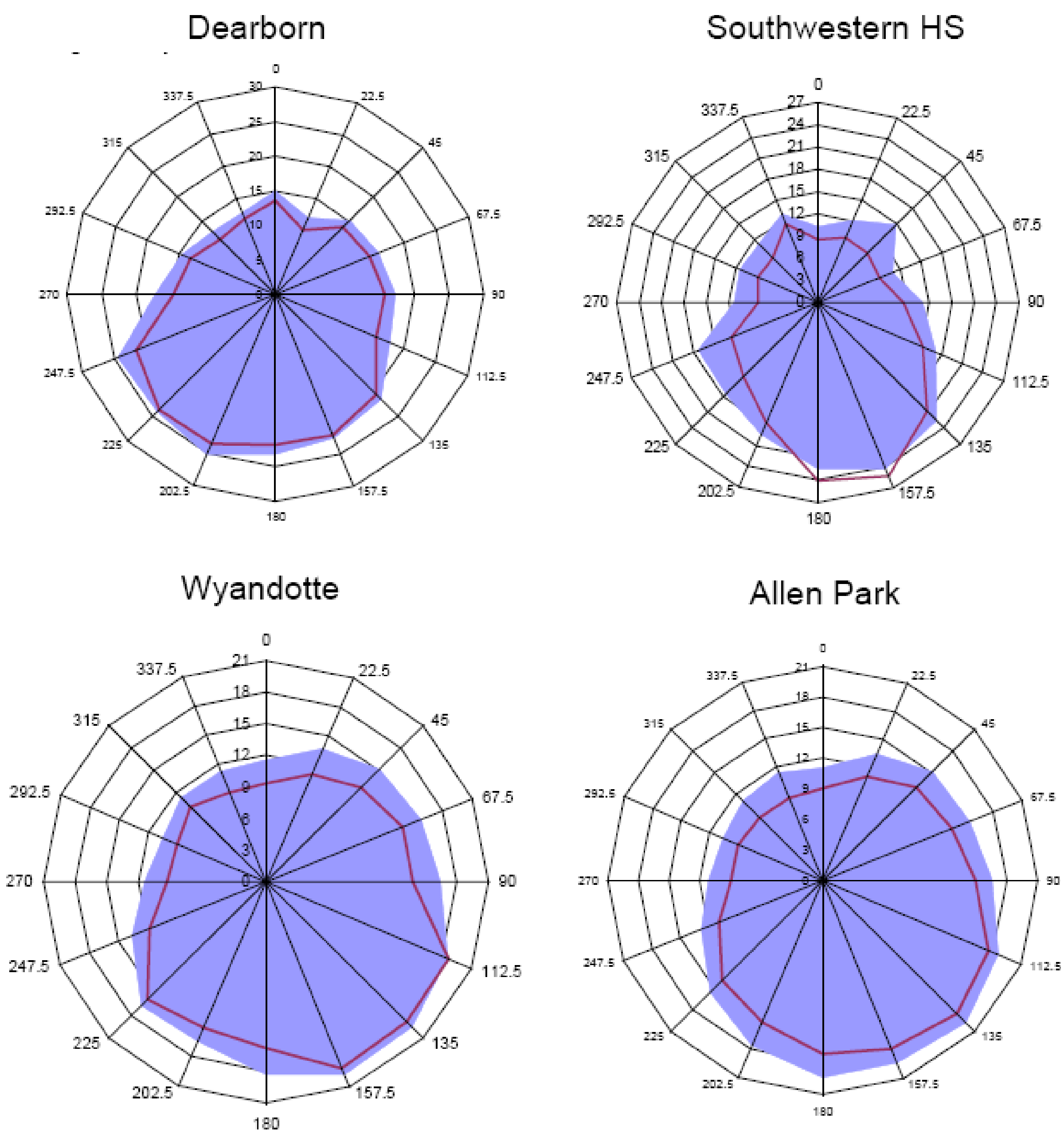


Figure 1.k
Average PM2.5 Concentrations
by Wind Direction
2003-2004



Source: MDEQ

Additional monitoring data is available for analysis

With the passage of time, as the initial analyses described above were conducted, additional monitoring data were collected and analyzed. This allowed us to see if the new data supported or invalidated our initial findings.

The results were encouraging on a number of fronts. Improvements were being measured at all monitors. In fact, the site at Luna Pier was measuring attainment and EPA revised its initial proposal for Toledo, designating it an attainment area. This confirmed our initial finding that while located in the Southeast Michigan region, Luna Pier's particulate levels tracked more closely with those of Toledo.

Also, values at sites marginally out of compliance (Linwood, Allen Park and Wyandotte) were being reduced. These reductions were expected, and can be attributed to the ubiquitous nature of many of the multistate pollution reduction programs being phased in. It was becoming clearer that these marginal sites would soon be in compliance with the standard.

Levels at Dearborn and SWHS monitors also improved but remained higher than all the other areas of the region. Initial findings that local controls would have to be implemented to complement the benefits of "on the books" multistate controls were reaffirmed.

Honing in on solving the problem required more extensive analysis

This reaffirmation resulted in a commitment to do more refined analysis to provide information from multiple perspectives. This included investigations of monitoring, modeling, and emissions inventory data. The multiple perspective analysis was designed to help sort out similarities and differences in study results in order to answer several policy questions:

- How much will regional reductions in emissions help? When?
- How much will local controls help?
- How well can we further pinpoint local sources and the species of $PM_{2.5}$ they contribute?

We learned it was reasonable to expect significant reductions in emissions and that regional reductions would contribute to reducing particulate levels from 1.5 and 1.9 $\mu g/m^3$ between 2005 and 2009 (see Table 1.a). The most helpful regional reductions would come from sources typically upwind of the Dearborn and SWHS monitors.

However, to the minor extent that other, typically downwind, sources in the region contribute to the problem, there would be some incremental benefit from the major emission reductions occurring from regional controls. **More importantly, if the impact of these downwind sources on excess levels was being underestimated, their beneficial impact on attainment (due to reductions from**

regional controls) was also being underestimated. Thus, we reaffirmed that local reductions were needed to reduce the excess particulate at this site.

Table 1.a
Forecasted Change in $PM_{2.5}$ Concentrations between 2005 and 2009
Due to Regional and National On-the-Books Controls

County	Monitor	Average Concentration			2005 Base Year Design Value[1]	2009 Design Value[2]	Forecasted Decrease
		'03-'05	'04-'06	'05-'07			
Wayne	Dearborn	18.2	17.2	17.2	17.5	15.8	-1.7
Wayne	Southwest HS	16.4	15.8	15.5	15.9	14.2	-1.7
Wayne	Wyandotte	15.4	14.3	14.3	14.7	13.1	-1.6
Wayne	Linwood	15.2	14.2	14.3	14.6	13.1	-1.5
Wayne	Allen Park	15.1	14.5	14.0	14.5	13.0	-1.5
Wayne	E. 7 Mile	14.8	14.1	14.1	14.3	12.9	-1.4
Monroe	Luna Pier	14.1	13.8	13.8	13.9	12.2	-1.7
Washtenaw	Ypsilanti	14.3	13.6	13.7	13.9	12.2	-1.7
Oakland	Oak Park	14.3	13.4	13.6	13.8	12.4	-1.4
St. Clair	Port Huron	13.8	13.1	13.2	13.4	11.8	-1.6
Wayne	Livonia	13.9	13.1	13.2	13.4	11.8	-1.6
Macomb	New Haven	13.0	12.5	12.5	12.7	11.4	-1.3

Source: LADCO Round 5 Modeling
[1]Average of three 3-year periods, centered on 2005
[2]Does not include impact of local controls at Marathon, U.S. Steel and Severstal.

Improvements in air quality continue, implementation of local reductions begins

Monitoring data through 2007 were now available. Analysis of these data led to the following findings:

- $PM_{2.5}$ levels continued to improve at all sites with the largest improvements at the sites of greatest concern (see Figure 1.l).
- The organic excess at Dearborn declined for reasons we are not yet able to explain.
- Unusually high levels were measured in 2005 in a multistate domain, (i.e., were unrelated to local changes in emission levels), see Figure 1.m.
- Despite the 2005 levels, the trend remained downward and **all but two sites were measuring attainment.**

Figure 1.l
3-Year Average PM2.5 Concentrations Southeast Michigan

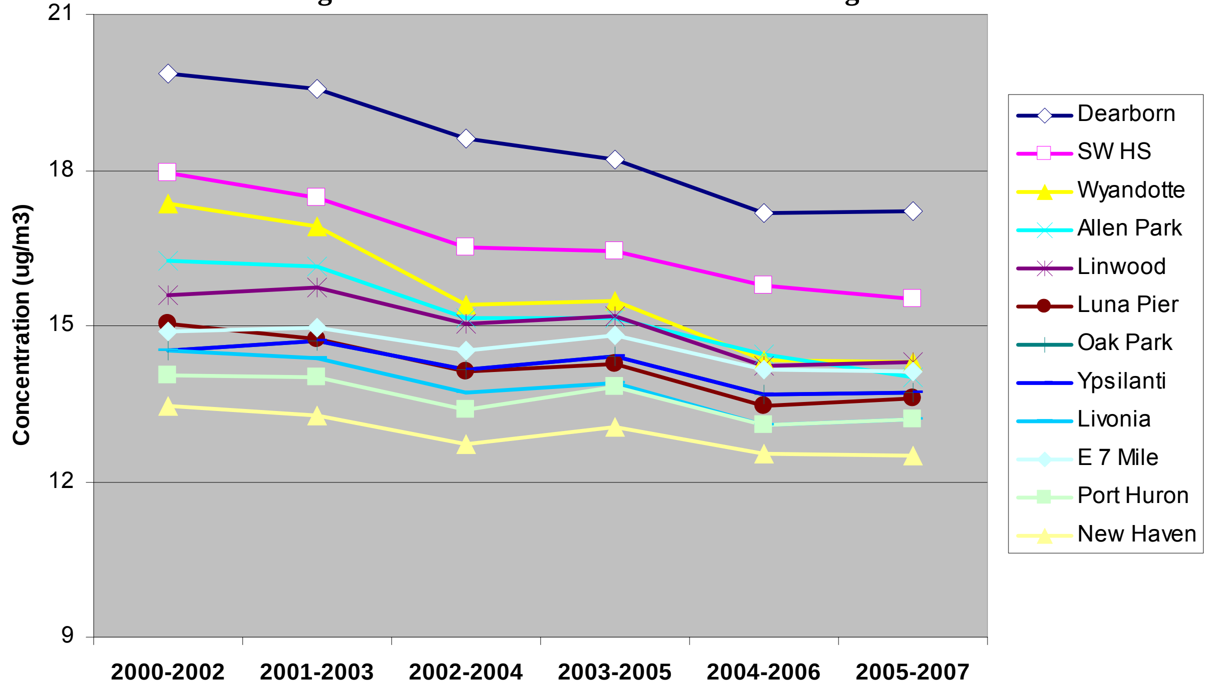
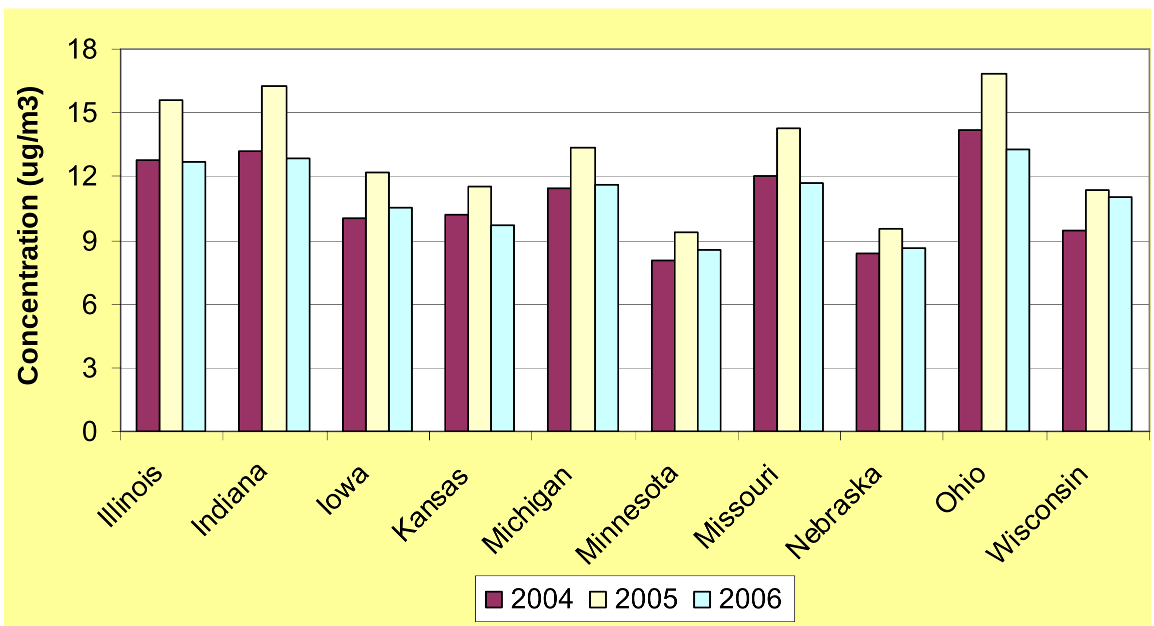


Figure 1.m
Average Annual Statewide $PM_{2.5}$ Concentrations – Midwest States



In that same timeframe, implementation of local controls began. These included the installation of controls at Severstal Steel, reduced emissions at the Marathon Oil refinery, reductions at U.S. Steel, and the modification of several continuously operated switch engine locomotives in the rail yard adjacent to the Dearborn monitor. These local controls were designed to supplement the benefits from regional reductions and to provide the additional increment needed to bring the Dearborn monitor into attainment.

Furthermore, as of 2007 the SWHS site is marginally over the standard (15.5 $\mu g/m^3$) and will most likely measure attainment at the end of 2008. There are three key reasons supporting this expectation that the 3-year average will decline by another 0.5 $\mu g/m^3$ at the end of 2008. First, significant multistate emission reductions will continue reducing the regional contribution. Second, some of the benefits of local controls will begin accruing. And third, the unusually high values from the episode of 2005 will not be in the 3-year average (the average for the last 2 years is 14.6 $\mu g/m^3$).

Actions moving forward

The Michigan Department of Environmental Quality (MDEQ) will be tracking the benefits of the local emission reductions described above. As best as possible, the impacts of meteorology (positive or negative) will be taken into account.

Also, as part of its partnership with MDEQ, the Southeast Michigan Council of Governments (SEMCOG) purchased a continuous elemental carbon/organic carbon (EC/OC) monitor to gain a deeper understanding of OC levels in the Dearborn area. Data from this monitor, which began operating in June 2007, will allow creation of a multiyear database to track trends.

Finally, SEMCOG and MDEQ continue partnering to improve the region's air quality and have already initiated several steps in developing a plan for the newly promulgated 24-hour standard for fine particulate. While the strategy for complying with the annual average will contribute to attaining the new daily standard, we expect more action will be necessary.

A consulting contract to develop a conceptual model for days with high $PM_{2.5}$ concentrations has already been completed and will be used to craft another attainment strategy to address the unique aspects of the 24-hour standard (see Appendix I). While focused on explaining high daily $PM_{2.5}$ concentrations, data from this conceptual model also reinforces the strategy of targeted local reductions to attain the annual standard. Figure 5.5 in Appendix I shows the amount of local $PM_{2.5}$ excess, by wind direction, at six of the monitors in Southeast Michigan on days with high fine particulate concentrations. In all cases the local excess is highest when winds are coming from the region's urban industrial core. This confirms that emission reductions to bring the Dearborn monitor into compliance must come from this urban core.

The results of the conceptual model have also led us to pursue additional analyses over the coming months. These analyses will provide a clearer explanation of the source contribution of specific $PM_{2.5}$ components, particularly OC, nitrate, and zinc. This continuing work will further expand Southeast Michigan's wealth of information and knowledge regarding fine particulate concentrations in the area.

2. Background and Overview of the $PM_{2.5}$ Rule

2.1 General Background/History of the $PM_{2.5}$ Rule

The EPA promulgated the NAAQS for $PM_{2.5}$ in July 1997. Since the EPA lacked sufficient air quality data to make designations for the newly promulgated standards, Congress passed legislation that delayed designations until three years of air quality data were collected by EPA-approved air quality monitors. The first monitors were put in place in 1998; however, a number of additional monitors did not come online until 1999, and therefore three complete years of data could not be collected until the 2000-2002 time period.

After the EPA promulgated the $PM_{2.5}$ standard, several industry organizations and state governments challenged the EPA's action in the U.S. Court of Appeals for the District of Columbia Circuit (the D.C. Circuit). On May 14, 1999, the D.C. Circuit held that the CAA, as applied by the EPA in setting the 1997 standards for particulate matter (PM) and ozone, was unconstitutional as an improper delegation of legislative authority to the EPA. The ruling did not question the science or decision-making process used to establish the standards. The court remanded the $PM_{2.5}$ standards to the EPA but did not vacate them. In June 1999, the Department of Justice (DOJ) and the EPA petitioned the D.C. Court for a rehearing and the D.C. Court denied the petition.

The DOJ and the EPA then filed a petition with the United States Supreme Court in December 1999 to appeal the decision of the D.C. Circuit. The Supreme Court held that the EPA's approach to setting the NAAQS was in accordance with the CAA and did not constitute an unconstitutional delegation of authority. The Supreme Court also affirmed that the CAA requires the EPA to set standards at levels necessary to protect the public health and welfare, without considering the economic costs of implementing the standards. The Supreme Court remanded several other issues back to the D.C. Circuit, including the issue of whether the EPA acted arbitrarily and capriciously in establishing the specific levels of the standards.

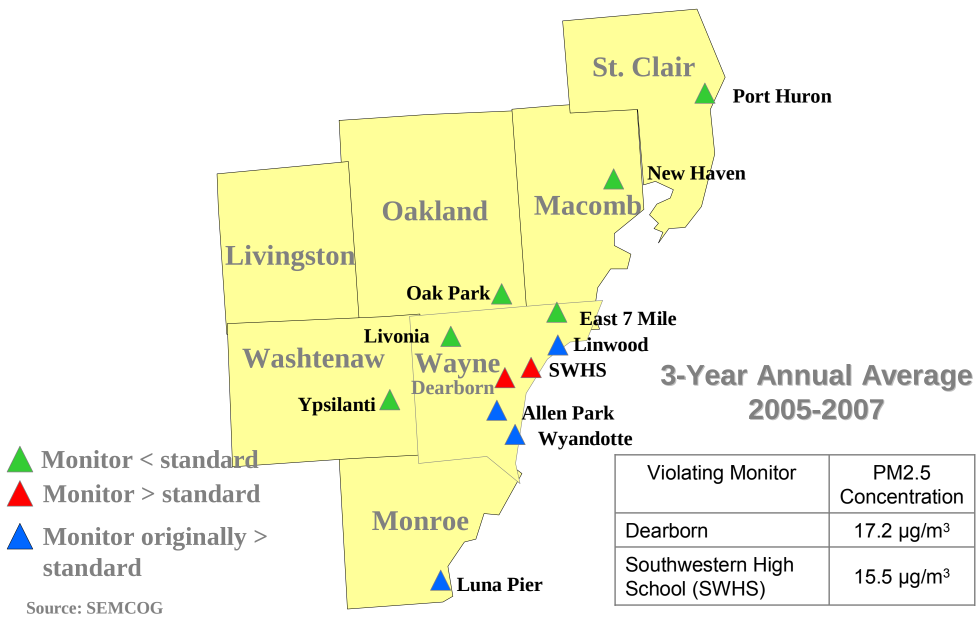
The D.C. Circuit heard arguments in this remanded case in December 2001 and issued its decision on March 26, 2002. The D.C. Circuit rejected the claim that the EPA had acted arbitrarily and capriciously in setting the levels of the standards. This last decision by the D.C. Circuit gave the EPA a clear path to move forward with implementation of the $PM_{2.5}$ standards.

2.2 Michigan Nonattainment Areas

With the court's support and sufficient data, the EPA could now move forward with nonattainment designations. States were directed to submit their recommendations for designations of attainment and nonattainment. The MDEQ recommended that only Wayne and Monroe Counties be designated as nonattainment for $PM_{2.5}$ and that each county be designated as a separate nonattainment area.

In June 2004, the EPA proposed a seven-county $PM_{2.5}$ nonattainment area for Southeast Michigan including Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne Counties (Figure 2.2.a). The MDEQ submitted a letter in September 2004, again requesting two nonattainment areas of only Wayne and Monroe Counties instead of seven counties.

Figure 2.2.a: PM2.5 Nonattainment Area showing the location of PM2.5 monitors

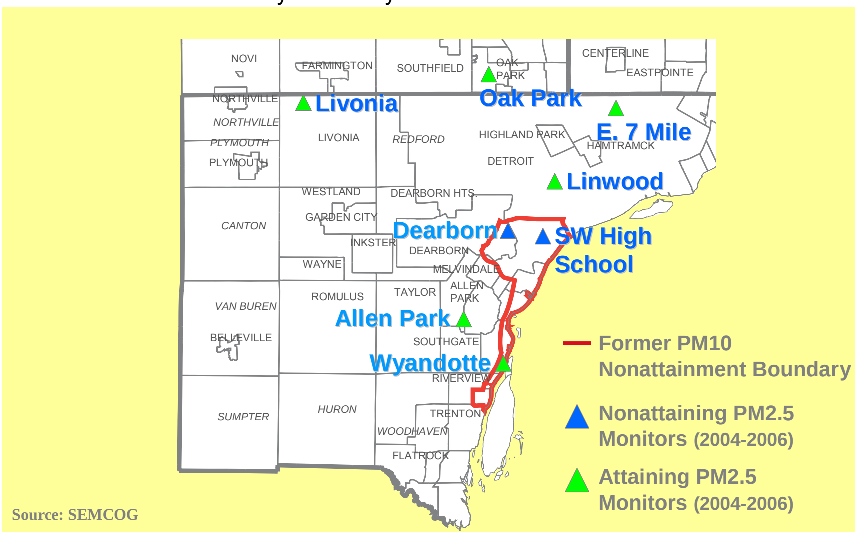


Violating Monitor	PM2.5 Concentration
Dearborn	17.2 µg/m³
Southwestern High School (SWHS)	15.5 µg/m³

In that letter, the MDEQ stated that the seven-county nonattainment area in Southeast Michigan was arbitrary based on current and historical monitoring data for particulate matter. The monitors showing violation of the standard in Wayne County are located in an area with a history of particulate matter problems, associated with local industrial sources. Figure 2.2.b shows the location of these monitors relative to the former PM_{10} nonattainment area. As the map illustrates, the areas are nearly identical. The primary source of the former PM_{10} problem was determined to be a few local industrial sources. Emissions from these sources were reduced and the region came into compliance in 1996[1].

[1] These emission reductions probably also helped lower $PM_{2.5}$ concentrations in the area. However, no long-term $PM_{2.5}$ monitoring data exist to determine the degree of improvement.

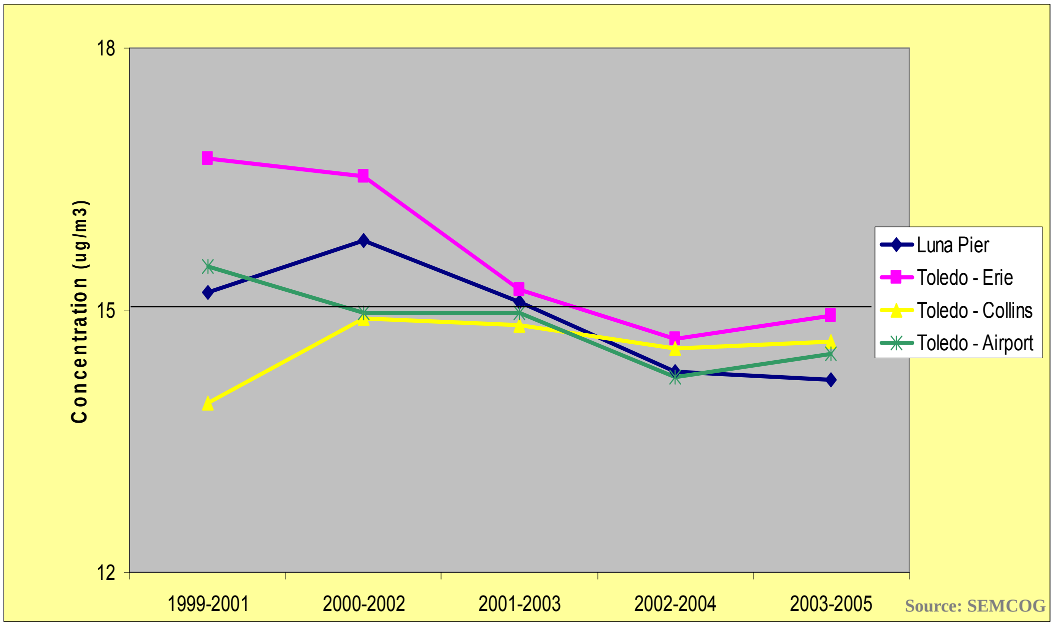
Figure 2.2.b: Former PM10 Nonattainment Area with Overlay of PM2.5 Monitors Wayne County



The MDEQ also asserted that most of the monitors in the seven-county area were measuring attainment, making a widespread nonattainment designation inappropriate from a regulatory perspective and misleading from a public health perspective. Several monitors measuring attainment in the seven-county area are downwind of the monitors showing violations of the standard (i.e., all counties north of Wayne and Monroe Counties). Adding controls in these downwind counties would not address the nonattainment in Wayne and Monroe Counties. In addition, transport of $PM_{2.5}$ precursors from these counties would be addressed through the EPA's Clean Air Interstate Rule (CAIR) and nitrogen oxides (NOx) SIP call.

The Luna Pier monitor, located in the southeastern corner of Monroe County, is one mile north of the Ohio border. In the February 2004, $PM_{2.5}$ nonattainment designation recommendation to the EPA, the MDEQ asserted strongly that Monroe County should be designated as a separate nonattainment area from Wayne County because $PM_{2.5}$ levels at the Luna Pier monitor tracked more closely with those in Toledo, Ohio (Figure 2.2.c).

Figure 2.2.c: 3-Year Average PM2.5 Levels Toledo and Luna Pier



Trend data showed that levels at the Luna Pier site had been decreasing in recent years and would likely measure attainment by 2004. Levels at the site have continued to track those in Toledo, and monitors in both areas have measured attainment of the standard since 2004. In 2005, EPA redesignated the Toledo area as attainment, but Luna Pier is still considered nonattainment because it was grouped with the Detroit nonattainment area.

The EPA made final nonattainment designations in April 2005. Disregarding the MDEQ's recommendations, the EPA designated a seven-county area in Southeast Michigan as not attaining the $PM_{2.5}$ standard. As of 2006, the only monitors that currently record $PM_{2.5}$ concentrations above the standard are in the industrialized section of Detroit in Wayne County.

3. General Planning Provisions

Pursuant to the requirements of 40 CFR 51, Appendix W, the MDEQ submits this SIP to meet the requirements of the EPA's Fine Particulate rules, which were adopted to comply with CAA requirements.

The MDEQ has authority to submit this SIP under Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451).

The MDEQ provided public notice of the opportunity to comment on the SIP on February 4, 2008. On February 4, 2008, MDEQ also provided notice of the opportunity for a public hearing if requested on March 11, 2008. Public comments were addressed and are summarized in Appendix B.

4. State Implementation Plan Approval and Compliance with CAA Section 110 and Part D Requirements.

Section 110 of the CAA delineates general SIP requirements and Part D contains requirements applicable to Subpart 1 nonattainment areas. The language in MDEQ's current rules refers to "particulate matter," which would apply to any size fraction of particulate matter (e.g., PM_{10} or $PM_{2.5}$). This provision in Michigan's current law is adequate for the current SIP submittal and any future changes to the particulate matter standards. The MDEQ meets all the requirements of Section 110(a) SIP elements.

Programs for emissions limitations, permitting, emissions inventories and statements, ambient monitoring, Reasonably Available Control Technology (RACT), Reasonably Available Control Measures (RACM) and contingency measures are included in the MDEQ SIP.

Subpart 110(a)(2)(D) requires that SIPS contain certain measures to prevent sources in a state from significantly contributing to air quality problems in another state. The MDEQ has met the requirements of the federal CAIR to reduce NOx and sulfur dioxide (SO_2) emissions contributing to downwind states. The MDEQ's rules to implement the CAIR have been conditionally approved in a rule (Volume 42, Number 244, December 20, 2007).

The MDEQ administers a New Source Review (NSR) permitting program for major and modified sources of PM in nonattainment areas under the MDEQ's permit program. Permits to install cannot be issued unless the applicant can demonstrate that increased emissions from the new or modified source will not result in a violation of the NAAQS.

5. Local Planning

The SIP was developed in close consultation with SEMCOG and its air quality task force and technical advisory group. SEMCOG is the metropolitan planning organization for Southeast Michigan and the lead local air quality planning agency under the CAA.

In the early 1990s, SEMCOG formed the Southeast Michigan Ozone Study (SEMOS), an air quality technical advisory group to help understand the cause of air quality problems in the region and the sources that contribute to them. While the group's name implies that its focus is ozone, its mission is much broader. The group has been instrumental in the procurement and analysis of air quality data used in ozone, carbon monoxide, and $PM_{2.5}$ SIP development. SEMOS members are a diverse group of analysts, modelers, and scientists from both industry and government. While it includes many local stakeholders, representatives from the MDEQ, the EPA, Lake Michigan Air Directors Consortium (LADCO), and Canadian national and provincial environmental agencies also participate.

While SEMOS deals with the complex, technical aspects of air quality, SEMCOG's Air Quality Task Force addresses the local policy-related issues. The Task Force, which was originally formed in the 1990s to address the ozone and carbon monoxide NAAQS, was reconvened in 2003 to help evaluate strategies for bringing Southeast Michigan into attainment of the new 8-hour ozone standard and continues its activity in addressing $PM_{2.5}$. The Task Force is comprised of state and local policymakers, industry representatives, and other community stakeholders.

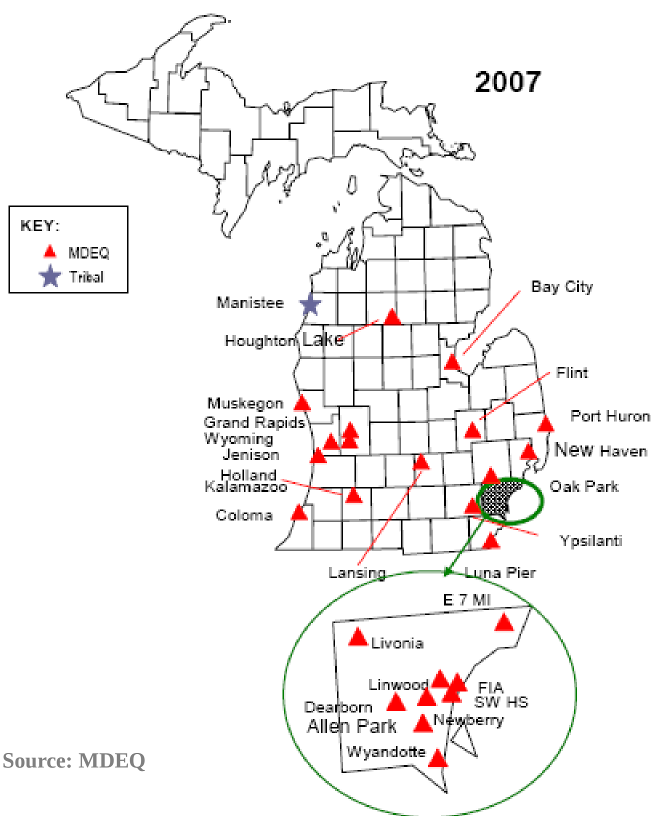
This SIP utilizes data that was gathered and analyzed by SEMOS and evaluated by the Air Quality Task Force. By coordinating with local, state and regional members, MDEQ has worked to ensure that its strategy provides reasonable reductions to mitigate impacts of sources on affected $PM_{2.5}$ nonattainment areas.

6. Monitoring

Section 110(a)(2)(B) of the federal CAA requires a monitoring strategy for measuring, characterizing, and reporting $PM_{2.5}$. The MDEQ maintains a comprehensive network of $PM_{2.5}$ air quality monitors throughout Michigan with the primary objective being to determine compliance with the $PM_{2.5}$ NAAQS. The MDEQ submits network reviews[2] to the EPA Region 5 annually to ensure that its air monitoring operations comply with all applicable federal requirements.

Due to state and federal budget cuts, the MDEQ has reduced its monitoring network since the $PM_{2.5}$ designations were made. However, no reductions in the $PM_{2.5}$ Federal Reference Method (FRM) network in the designated nonattainment area were made. The $PM_{2.5}$ monitoring network is shown in Figure 6.a.

Figure 6.a: Michigan's 2007 $PM_{2.5}$ FRM monitoring network.



Source: MDEQ

[2] See http://www.deq.state.mi.us/documents/deq-aqd-air-aqe-Monitoring-Network-Review-final-9-6-07.pdf for MDEQ's 2006 network review.

7. Emissions Inventory

Rule 40 CFR 51.1002 (c) requires pollutants contributing to fine particles to be part of a state's SIP. The MDEQ believes that primary particles (EC/OC and crustal material), SO_2, and NOx are the main components of $PM_{2.5}$, and they are included in our analyses. Volatile organic compounds (VOCs) and ammonia (NH3) are included in the emissions inventory (and modeling inventories); however, they are not a part of the MDEQ's current attainment strategy for $PM_{2.5}$. VOCs' contributions to $PM_{2.5}$ are still being investigated, and therefore control measures for these compounds will not be included in this SIP (although controls for VOCs have been implemented for ozone nonattainment). NH3 emission estimates and atmospheric chemistry are very uncertain; therefore, the MDEQ is not including NH3 controls in this SIP revision.

Rule 40 CFR, Part 51.1008(a) requires the MDEQ to submit to the EPA statewide emission inventories for direct $PM_{2.5}$ emissions and emissions of $PM_{2.5}$ precursors. The MDEQ must also submit any additional emission inventory information needed to support an attainment demonstration and Reasonable Further Progress (RFP) plan necessary to ensure expeditious attainment of the standard. The 2005 base year inventory for Michigan has been submitted to the EPA pursuant to 40 CFR, Part 51, Subpart A – Emission Inventory Reporting Requirements.

As specified in the applicable EPA guidance, the emissions inventory for Michigan includes primary $PM_{2.5}$, SO_2, NOx, VOCs, and NH3.

A description of the methodology used to prepare the inventory appears in Appendix C. Mobile estimates for the nonattainment counties were prepared by SEMCOG and appear in Appendix D. Mobile emissions for other counties were prepared by the Midwest Regional Planning Organization's (MRPO) contractor using traffic and vehicle information provided by the Michigan Department of Transportation (MDOT). The Lake Michigan Air Directors Consortium (LADCO) is the MRPO. A summary of the emissions inventory is shown in Table 7.a. The MDEQ will update this inventory on a periodic basis every three years.

In addition, emissions were projected to 2009 to support the attainment demonstration. The base year and 2009 modeling inventories were prepared by LADCO. The future year projections take into account existing control measures and measures that are known to be on the way (e.g., CAIR measures). This inventory is referred to as the LADCO Base-M inventory. Procedures used to prepare these inventory products can be found in the "Regional Air Quality Analyses for Ozone, $PM_{2.5}$, and Regional Haze: Technical Support Document," prepared by LADCO. LADCO has produced numerous summary reports with state and county total emissions and has posted them on their Internet site at:

http://www.ladco.org/tech/emis/basem/baseM_reports.htm

Table 7.a. Summary of Michigan's nonattainment area 2005 base year annual emissions per county per pollutant in tons per year (tpy) for area sources (area), nonelectric generating unit point sources (nonegu_pt), on-road mobile (on-road), off-road mobile (nonroad), electric generating unit point sources (egu_point), marine, air and rail (mar air rail), and ammonia sources (modeled nh3).

	County name	Livingston	Macomb	Monroe	Oakland	St_Clair	Washtenaw	Wayne	**Total**
pollutant	County ID	93	99	115	125	147	161	163	
	area	3.32	13.42	2.88	24.91	3.29	6.71	32.01	86.54
	nonegu_pt	0.15	16.24	79.41	19.73	10.33	4.48	132.61	262.95
	on-road	200.7	645.87	205.5	1319.26	171.71	388.25	1859.1	4790.39
	nonroad	1.3	4.42	1.44	7.24	1.71	2.66	8.48	27.25
	egu_point			2.59		11.78		1.8	16.17
	mar air rail	0.05	0.27	0.57	0.44	0.34	0.12	1.46	3.25
NH3	modeled nh3*	280.31	224.2	638.69	84.74	273.56	738.07	113.69	2353.26
	area	647.95	2498.84	606.83	4535.97	563.69	1056.74	6039.67	15949.69
	nonegu_pt	654.19	720.91	3774.97	1096.91	1978.16	1050.26	9408.81	18684.21
	on-road	5417.9	14121.2	5454.4	31088	3812.6	9962.2	43981.4	113837.7
	nonroad	1288.1	5054	1404.71	7153.48	1519.17	2999.65	9410.39	28829.5
	egu_point	5.91	134.42	38483.26	71.97	19690.31	1.45	11369.4	69756.72
	mar air rail	83.97	589.24	958.21	822.22	557.31	203.64	4166.3	7380.89
NOx	modeled nh3*								0
	area	1424.61	468.79	1176.54	761.34	341.99	245.58	920.34	5339.19
	nonegu_pt	7.35	113.13	668.31	124.44	112.5	86.86	1342.36	2454.95
	on-road	89.47	265.44	91	559.86	71.06	170.02	792.05	2038.9
	nonroad	120.62	339.65	121.96	614.54	108.58	2632.17	644	4581.52
	egu_point	0.1	12.83	597.66	8.86	142.13	0.02	352.76	1114.36
PM_{25}-	mar air rail	2.55	13.91	29.11	23.91	18.3	6.02	99.3	193.1
PRIM	modeled nh3*								0
	area	4338.29	11807.62	3663.62	17387.4	2671.18	5406.23	24887.81	70162.15
	nonegu_pt	176.95	2271.05	3555.73	2487.15	1379	388.83	6319.64	16578.35
	on-road	1696.9	5784.7	1742.6	11918	1550.9	3349.7	16931.1	42973.9
	nonroad	1927.32	4910.6	1893.76	9862.11	2166.18	2632.17	8396.96	31789.1
	egu_point	0.19	39.67	300.92	8.54	285.49	0	175.34	810.15
	mar air rail	23.38	114.92	61.48	93.3	43.26	19.96	460.03	816.33
VOC	modeled nh3*								0

pollutant	County name County ID	Livingston 93	Macomb 99	Monroe 115	Oakland 125	St_Clair 147	Washtenaw 161	Wayne 163	**Total**
	area	226.78	930.59	181.05	1187.41	238.8	325	1540.36	4629.99
	nonegu_pt	13.7	48.26	7733.15	274.99	1752.75	20.75	6396.53	16240.13
	on-road	71.32	221.44	72.83	458.48	59.06	136.9	647.06	1667.09
	nonroad	139.72	426.07	139.75	683.2	125.05	342.2	883.35	2739.34
	egu_point	0.07	4.32	120386.7	3.43	66576.72	0.28	40780.46	227751.98
	mar air rail	7.53	38.28	82.64	64.67	72.99	16.93	398.38	681.42
SO_2	modeled nh3*								0

* Emission from the NH3 Model for source categories not included in point, area or mobile categories (e.g. agriculture, etc.).

8. Transportation Conformity Budget

Transportation conformity is required by Section 176(c) of the CAA. The EPA's conformity rule requires that transportation plans, programs, and projects conform to SIPs and establishes the criteria and procedures for determining whether or not they do. Conformity to a SIP means that transportation activities will not produce new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS.

Estimates of on-road motor vehicle emissions are projected for the attainment year to assess emission trends and to ensure continued compliance with the $PM_{2.5}$ NAAQS. On-road emissions include those from cars, buses and trucks driven on public roadways. These estimates are considered a ceiling or "budget" for emissions and are used to determine whether transportation plans and projects conform to the SIP. Estimated on-road mobile emissions of primary $PM_{2.5}$ and NOx must not exceed the emission budget contained in the attainment plan. The emissions estimates for this sector reflect appropriate and up-to-date assumptions about vehicles miles traveled, socioeconomic variables, fuels used, weather inputs, and other planning assumptions. The methodology used to estimate mobile emissions in the nonattainment counties appear in Appendix D. The transportation emission budget for conformity is provided in Table 8.a.

Table 8.a: Transportation Conformity Budget for Southeast Michigan (in tons per year)

Scenario	**Emissions**	
	Primary $PM_{2.5}$	**NOx**
2009	1,470	75,500

Source: SEMCOG, *Southeast Michigan On-Road Mobile Source Emissions Inventory for the $PM_{2.5}$ State Implementation Plan,* January 2008.

9. Weight of Evidence (WOE)

Rule 40 CFR Part 51.1007(a) requires the MDEQ to submit an attainment demonstration showing that the area will attain the annual and 24-hour standards as expeditiously as practicable. The demonstration must include: 1) inventory data (see also section 7), 2) emission reduction analyses, and 3) modeling results on which the MDEQ bases its attainment date.

The WOE approach used in this SIP includes a variety of data sources to make the demonstration that the Southeast Michigan $PM_{2.5}$ nonattainment area will attain the standard by 2010. The MDEQ believes this approach is the most scientifically defensible approach because it relies on not one method, such as modeling, but multiple sources of information. This approach provides a more robust demonstration in light of the many uncertainties that remain regarding the relatively new $PM_{2.5}$ annual standard.

The data sources used in this demonstration include monitoring data, emissions inventory data, photochemical and dispersion modeling, and trend analysis. Taken together, this information provides adequate proof that the areas with the highest levels of $PM_{2.5}$ in the state, namely the Dearborn/SWHS monitoring areas, have been seeing substantial reductions in $PM_{2.5}$ levels over the last several years. It shows that regional controls of NOx and SO_2 are reducing $PM_{2.5}$ in these areas and throughout the state, and will continue to do so for the next several years. The information further shows that significant amounts of $PM_{2.5}$ come predominantly from local upwind industrial sources, and that control of these sources, primarily the nearby steel mill, will bring the area into attainment of the annual $PM_{2.5}$ standard by 2010.

The Detroit area has been recognized as having a rich source of air quality data and has been the site of many studies by the EPA (DEARS, multipollutant SIP study), the MDEQ (Detroit Area Toxics Initiative or DATI), University of Michigan, SEMCOG, LADCO and other contractors. Part of the reason for the rich data base is the high density of air quality monitors. These numerous monitors have allowed MDEQ to isolate, within a few miles, the areas of highest air pollution, and thus the areas of greatest concern.

The MDEQ's analysis and attainment strategy focused on the monitors in Wayne County that are not or were not showing attainment of the standard. While local strategies were not the only ones investigated, they proved to be the most effective for attaining the standard. As only two of the 13 monitors in the seven-county area are not in compliance with the standard, and these two violating monitors are within three miles of each other, area-wide controls were determined to be impractical and ineffective, particularly since federal requirements (CAIR, NOx SIP Call, mobile source controls, etc.) will already be controlling the major sources outside of Wayne County. Since monitoring trends and modeling data showed that regional on-the-books controls would result in attainment of the standard at all but the Dearborn monitor by 2009, our efforts primarily focused on identifying and reducing the local excess at Dearborn.

9.1 Fine Particulate Matter

In 1997, the EPA developed new NAAQS for fine particulate matter. The EPA designated the Southeast Michigan area (seven counties) as nonattainment. The three-year average concentrations for 2001-2003 showed six monitors were measuring violations of the annual $PM_{2.5}$ standard. Five of these monitors were in eastern Wayne County and the sixth was the Luna Pier monitor in southern Monroe County (see Figure 2.2.a).

As Figure1 in Appendix A shows, air quality in Southeast Michigan has steadily improved over the last eight years. Currently only two monitors are showing violations of the NAAQS standard: Dearborn and SWHS. These two are located in an area with a history of particulate matter problems associated with local industrial sources. Since the area successfully attained the PM_{10} standard after the application of local controls, the MDEQ believes that the most effective attainment strategy for $PM_{2.5}$ is to also focus on local emission reductions from sources in this area while national programs will control secondary regional pollutants in the entire nonattainment area and beyond. This strategy is supported by numerous studies showing a local excess at these two sites, particularly Dearborn that is not measured at other monitors as close as three miles away.

Fine particulate matter is a complicated mixture of ammonium sulfate, ammonium nitrate, OC, EC, soil (or crustal material) and other particles. Some $PM_{2.5}$, particularly in urban areas, is anthropogenic (man-made) in origin and some is biogenic (plant-made) in origin. $PM_{2.5}$ is composed of primary (directly emitted) and secondary (formed in the atmosphere) particles. Our understanding of how much $PM_{2.5}$ is primary versus secondary, and how fast secondary formation takes place, is limited. Current speciation analyses of ambient monitoring data indicate that $PM_{2.5}$ concentrations result from both primary emissions (e.g., crustal matter, EC, and much of OC), and secondary formation (e.g., ammonium sulfate, ammonium nitrate, and some OC).

As discussed above, $PM_{2.5}$ is composed of many different components that can come from a wide variety of sources. Few monitoring sites in Southeast Michigan have speciation monitors. Lack of speciated $PM_{2.5}$ data at most locations, especially some of those monitors that were originally showing violations of the standard (Linwood, SWHS, and Wyandotte), has made identification of specific local source contributors in these areas very difficult. One must make assumptions based on source proximity to neighboring monitors that do have detailed data available. However, as will be discussed throughout this WOE, data from the Allen Park and Dearborn monitors, only six miles apart, show significantly different species composition and source apportionments, particularly with regard to OC and crustal material. This implies that very localized emissions are impacting the monitors, particularly at Dearborn.

In addition to the complexity of the $PM_{2.5}$ mixture, quantification of $PM_{2.5}$ emissions is still evolving. Techniques for measuring these emissions are still being evaluated and debated by the EPA as well as others. Much of the current inventory cannot be measured directly. Instead estimates are made through other methods such as factoring total PM emissions (which includes total suspended solids and PM_{10}), or use of activity levels and emission factors. This adds to the complexity of determining local source contributions.

9.2 Emissions

Significant emission reductions in the Midwest are expected from national controls, including CAIR and additional motor vehicle reductions (Tier 2, the Diesel Rule and low-sulfur fuel requirements). The EPA's Mobile6 model predicts that VOC, NOx, and $PM_{2.5}$ emissions from on-road mobile sources alone will be reduced by approximately 50 percent between 2002 and 2009 in Southeast Michigan (see Figure 2 in Appendix A). In addition, national stationary source controls, including CAIR and the NOx SIP call, are expected to reduce point source NOx emissions by 40 percent and SO_2 emissions by 15 percent during this same time period. LADCO modeling of these control measures predicts they will result in a 1.3 – 1.7 $\mu g/m^3$ reduction in $PM_{2.5}$ mass concentrations at every monitor in the nonattainment area by 2009 (see Table 1 in Appendix A). These reductions already take into account expected economic growth and increases in travel. This is compelling evidence that areas in Southeast Michigan that are currently attaining the standard will remain in compliance.

While these reductions are already having a significant, positive impact in Southeast Michigan and both monitoring and modeling data indicated that they will bring SWHS into attainment by 2009, the same could not be said for Dearborn. Additional reductions in the vicinity of this site were clearly needed to ensure its compliance by the 2010 deadline.

The Dearborn monitor is located in the industrialized core of Detroit, which contains a complex array of emission sources (see Figure 3 in Appendix A). This monitor is within 1,000 yards of a steel mill (see Figure 4 in Appendix A). Analysis of speciated monitoring data, particularly the iron component, as well as local hotspot modeling, indicate that emission reductions resulting from planned controls at this steel mill will be very effective in bringing Dearborn into attainment (see Figures 5 and 6, Appendix A). Additional controls at the U.S. Steel facility and Marathon Oil refinery will provide even more emission reductions within a three-mile radius of this monitor. Based on a recent study contracted through EPA (RTI 2006) as well as permit application data, the MDEQ estimates these controls will provide a combined primary PM emission reduction of 317 tons/year (147 tons/year from controls at

Severstal derived from MDEQ PTI #182-05B -- see Table 2 in Appendix A and Appendix F for details; 76 tons/year from U.S. Steel baghouse replacement MDEQ Consent Order (CO) #1-2005 and Renewable Operating Permit (ROP) 199600123a; and 94 tons/year from Marathon through NSR settlement from PTI #388-07 -- see Table 3 in Appendix A).

A number of other industrial facilities in the area surrounding the Dearborn, SWHS, and Wyandotte monitors have either closed or scaled back their operations since 2002 (see Table 4 in Appendix A). These changes may be contributing to the more rapid decrease in $PM_{2.5}$ levels observed at industrial monitoring sites (see Figure 7 in Appendix A). While some of these changes are permanent (e.g., Honeywell), others may only reflect reduced operations due to Southeast Michigan's sagging economy. Monitoring analysis will continue to see if these trends change in future.

In addition to the on-road mobile emission reductions previously mentioned, significant reductions are expected from off-road mobile sources. The exact contribution of mobile sources at Dearborn is not yet known. However, the site is in close proximity to several rail yards, one of which is immediately upwind of the monitor. There are as many as 40 switch yard locomotives operating within 2.5 miles of the site and most operate 24 hours per day, seven days per week. Some of these rail operations are also in the vicinity of the SWHS monitor.

Over the next two years, 28 of the switch engines in this area will be retrofitted with anti-idling equipment. These retrofits are being funded through a $1.5 million federal Supplemental Environmental Project. Based on data from a similar project in Chicago (EPA 2004), this initiative is expected to reduce NOx emissions by 67 tons/year and PM by 2 tons/year. In addition, four switch engine locomotives at the CSX rail yard immediately adjacent to the Dearborn monitoring site will be rebuilt with smaller engines over the next two years, resulting in an annual emissions reduction of 66 tons of NOx and 1.8 tons of diesel PM. This project is being funding through the federal Congestion Mitigation Air Quality (CMAQ) program.

While the emissions reduction expected from retrofitting diesel switch engine locomotives is relatively small compared to those at the large stationary sources, they are expected to have some impact because of their low level of discharge and close proximity to the Dearborn monitor. In fact, modeling predicts the benefit of this control measure will have a much greater impact at Dearborn than at SWHS or Wyandotte (see Table 5 in Appendix A). Also see Figure 8 in Appendix A for the location of the rail yards listed in Table 5.

In the course of the MDEQ's technical analysis, a large number of storage piles, unpaved lots, and plots of barren land were observed within a three-mile radius of both the Dearborn and SWHS monitors (see Figure 9 in Appendix A). The vast majority of emissions from these "fugitive" sources are thought to be larger than $PM_{2.5}$. Nonetheless, the sheer number of them, and their possible aggregate impact, deserves attention. While many of these sources are already the subject of a regulatory program as the result of a previous SIP, more information is needed to determine the contribution of fugitive dust to $PM_{2.5}$ concentrations in the area and the specific sources of these emissions.

Other possible sources of local emissions are small point sources in the area that are exempt from the MDEQ's emissions inventory reporting because of lower emissions. Identification and study of these sources may occur in the future if funding becomes available.

The MDEQ also analyzed the impacts of additional NOx and SO_2 emission reductions throughout the nonattainment area to evaluate the need for broad-based controls such as RACT. The MDEQ performed a special photochemical model run of the seven-county nonattainment area with a 100 percent reduction in NOx and SO_2 for all source types. This provided a screening analysis of the impacts of a beyond-RACT control scenario. It was thought that if the run showed significant improvements in $PM_{2.5}$ annual levels, then more source-selective runs would be done. However, the modeling resulted in about 1 ug/m^3 reduction at the Dearborn monitor, and other monitors had less in the area (see Table 6 in Appendix A). This further reinforced the need for a localized emission reduction strategy in order to reach attainment. The application of RACT-type control measures throughout the seven-county nonattainment, beyond those already being implemented through the NOx SIP call and CAIR, would do little, if anything, to address the $PM_{2.5}$ excess at Dearborn and therefore would not address the true source of the fine particulate problem in this area.

9.3 Monitoring

For the purpose of weight of evidence, monitoring data clearly supports the MDEQ assessment that attainment of the annual $PM_{2.5}$ standard will be achieved by 2010. Levels of $PM_{2.5}$ in the nonattainment area have been on a downward path for a number of years, and this trend is expected to continue.

The latest three-year average concentration (2005-2007) shows that only two of the original six monitors are still exceeding the standard: Dearborn and SWHS. Since 2000, $PM_{2.5}$ concentrations at all sites in the region have steadily declined. Overall, the three-year average concentration dropped 1.5 µg/m^3 between the 2001-2003 and 2005-2007 time periods. The largest and fastest decreases have occurred at the sites with the highest concentrations in the industrial core: Dearborn (2.3 µg/m^3), SWHS (2.0 µg/m^3), Allen Park (2.1 µg/m^3) and Wyandotte (2.6 µg/m^3) (see Table 7 in Appendix A).

Despite a rise in 2005 $PM_{2.5}$ concentrations in Southeast Michigan and indeed the entire Midwestern United States as a whole, there has been a strong downward trend in Southeast Michigan's $PM_{2.5}$ concentrations over the last six years (see Figure 1 in Appendix A). In fact, every monitor in Southeast Michigan recorded its lowest annual average $PM_{2.5}$ concentration in 2006 or 2007 (see Table 8 in Appendix A). As a result, the last two three-year annual averages (2004-2006 and 2005-2007) show three additional monitors - Allen Park, Linwood and Wyandotte - are now measuring $PM_{2.5}$ levels that meet the standard. In addition, the annual average at SWHS has been below the standard in both 2006 (14.68 $\mu g/m^3$) and 2007 (14.54 $\mu g/m^3$), and we expect the three-year average for this monitor to demonstrate attainment by the end of 2008.

Examination of trends in $PM_{2.5}$ chemical species between 2002 and 2006 shows downward trends for sulfates, nitrates, and OC at Dearborn, Allen Park, and Luna Pier. The downward trend in OC is statistically significant at all three sites, with the greatest decrease occurring at Dearborn (-0.54 ug/m^3/year, see Table 9 in Appendix A).

$PM_{2.5}$ in Southeast Michigan is comprised largely of sulfates, nitrates, and OC with small contributions from EC and crustal material (or soil, see Figure 10 in Appendix A). Various analyses of both local and regional monitoring data all indicate that Southeast Michigan's nonattainment problem is caused by a combination of regional transport and local emissions from sources in the vicinity of the monitors showing violations of the standard. A LADCO analysis of rural background concentrations versus urban excess in the Midwest showed the majority of $PM_{2.5}$ measured in our region is coming from outside Southeast Michigan (see Figure 11 in Appendix A).

Monitoring data indicates that emissions from counties to the north of Wayne County do not contribute to $PM_{2.5}$ nonattainment at the monitors showing violation of the standard. Analysis of this data shows that the vast majority of the urban excess at these monitors on days when winds are from the northeast, north or northwest comes from within Wayne County. Little increase is attributable to Oakland and Macomb Counties. And in all cases, average concentrations at the nonattainment monitors are well below the 15ug/m^3 annual standard when winds are from these directions (see Figures 12 and 13 in Appendix A). Furthermore, a recently developed conceptual model for days with high PM2.5 concentrations shows that local fine particulate excess at various monitors in the region is consistently highest when winds are coming from Wayne County's urban industrial core. Thus, rather than emissions from outlying counties contributing to the local excess at Dearborn, it is the emissions generated in the highly industrialized portion of Wayne County that are impacting the outlying counties (see Figure 5.5, page 43 in Appendix I).

The regional background alone is not high enough to cause a violation of the standard, since all $PM_{2.5}$ monitors in the Southeast Michigan nonattainment area that are less impacted by local sources are meeting the standard (see Figure 1 and Table 8 in Appendix A). However, two of the components of $PM_{2.5}$, OC, and soil, have a higher (though declining) local contribution (see Figure 14 in Appendix A).

Within Southeast Michigan, crustal matter is significantly higher at the Dearborn monitor, even though this monitor is less than three miles from several others (see Figure 15 in Appendix A). As mentioned earlier, the crustal component is largely composed of iron (see Figure 6 in Appendix A). A wind rose for the iron component of $PM_{2.5}$ at Dearborn points directly to the southwest. Conversely, the iron wind rose for Allen Park, while measuring much lower levels, points to the northeast (see Figure 16 in Appendix A). The Allen Park monitor is approximately five miles southwest of Dearborn. Additional wind direction analysis shows that, when winds are from the southwest (the predominant wind direction), average crustal concentrations at Dearborn are over 2.5 $\mu g/m^3$ higher than those at Allen Park and are sometimes as much as 6 $\mu g/m^3$ higher (see Figure 17 in Appendix A). This clearly indicates a significant local iron source directly between these two sites and closer to the Dearborn monitor.

Additional evidence of a local emissions source is seen in total $PM_{2.5}$ as well. The incremental difference in $PM_{2.5}$ concentrations at Dearborn is greatest when compared to monitors to the southwest and west of this site (see Figure 18 in Appendix A). This indicates that there is a large local source between Dearborn and the "background" monitors (Allen Park, Luna Pier and Ypsilanti). The Severstal steel facility lies in exactly this position (see Figure 19 in Appendix A). As part of a consent order and permit with the MDEQ, this facility is in the process of installing new baghouses on its blast furnaces and basic oxygen furnace, as well as other control equipment. These changes are expected to reduce primary $PM_{2.5}$ emissions at this facility by 147 tons/year (see Table 2 in Appendix A and Appendix F for additional details).

In addition to crustal material, OC is significantly higher at the Dearborn monitor (1.5 - 2.0 $\mu g/m^3$ higher), even though this monitor is less than three miles from several others (see Figure 15 in Appendix A). The Dearborn wind rose for OC indicates a more even distribution than iron, but still shows noticeably higher concentrations when the wind is from the west, southwest or south (see Figure 16 in Appendix A).

A separate analysis of OC levels by wind direction indicates that the decrease at Dearborn is occurring at a faster rate than at Allen Park (see Table 10 in Appendix A). This provides corroborating evidence that local sources are significantly impacting OC at Dearborn. A faster decrease of OC at Dearborn compared to Allen Park is also shown in Figure 20 in Appendix A. It indicates that OC concentrations are becoming more similar to Allen Park and the difference between the sites has decreased by about 1 ug/m^3 in the past 5 years. However, the specific sources(s) of this excess OC have yet to be identified.

Currently, we are unable to explain the observed decrease in excess OC unique to Dearborn. If this reduction is permanent, future analysis focused on explaining this urban excess will be difficult.

9.4 Organic Carbon: More Study Needed

Determining the source of local OC emissions is difficult. Results of source apportionment studies conducted to date are not definitive due to data limitations. However, the data indicates a significant local industrial component at Dearborn that exceeds that seen at Allen Park and other sites in Southeast Michigan. Mobile sources also appear to significantly contribute to the OC mass (see Figure 21 in Appendix A). Further analysis is needed to identify the source(s) of OC excess at Dearborn and determine how it can be controlled. To this end, the MDEQ, with support from SEMCOG, has initiated continuous monitoring for OC at Dearborn. LADCO is sponsoring additional measurement-based source apportionment studies as well.

To help understand the OC fraction, six recent source apportionment studies (based on the positive matrix factorization [PMF] statistical analysis method) were examined (Kenski 2007, see Figure 22 in Appendix A and Appendix G). Several common findings are:

- At Dearborn, the source apportionment studies indicate that local industrial sources, including steel manufacturing but also other metal industries, likely contribute 2.5-3.5 ug/m^3 to annual average $PM_{2.5}$.
- Dearborn also experiences higher mobile source impacts than Allen Park (1.3 to 1.7 ug/m^3 greater), and much of the increase is from diesel sources.
- Secondary sulfate and nitrate levels do not differ much between Allen Park and Dearborn, evidence that these levels are not being influenced by local sources. However, some of the industrial source fingerprints did include sulfate mass, which indicates that local sources of sulfate are present and need further evaluation.

Chemical mass balance (CMB) analyses on high $PM_{2.5}$ days at Dearborn show varied patterns, suggesting that varying mixtures of sources are impacting this site on any given day. Plumes from industrial sources as well as emissions from smoking vehicles appear evident in these episodes (see Figure 23 in Appendix A). However, the observed contribution from smoking vehicles is not unique to Dearborn. The same patterns are evident at Allen Park and other sites in Southeast Michigan, as well as sites in other parts of the Midwest where this analysis has been done. Thus, smoking vehicles do not appear to explain the $PM_{2.5}$ excess being measured at Dearborn (STI 2006).

Additional studies that have been conducted in Detroit to help assess the sources of $PM_{2.5}$, particularly for OC, are still being analyzed. However, preliminary results of one study done by an advanced mobile laboratory from Canada (CRUISER) showed some peaks in OC from high vehicle traffic areas, trains, and a sausage smoking factory (see Figure 24 for the monitor data and Figure 25 for the map locations in Appendix A). In addition, upwind/downwind analysis of one of the Detroit steel mills showed a large difference in $PM_{2.5}$, particulate sulfate, black carbon, and several precursors, as well as a small (0.8 ug/m^3) increase in OC (see Table 11 in Appendix A). Although this was only one sampling event taken in a short time period, it does indicate that this steel mill may have a significant amount of particulate emissions, but may only be a moderate source of particulate OC.

Another preliminary analysis by LADCO used nonparametric regression and kernel density estimates to regress continuous monitor concentrations to wind speed and wind direction data to map locations of relatively high OC and black carbon sources. This study was done at Dearborn and Allen Park as well as the Newberry and FIA (or Lafayette Street) sites, two of MDEQ's new monitoring sites, because they have the necessary black carbon continuous monitors. Newberry also has an OC continuous monitor.

A highly industrialized area near Zug Island was indicated for high black carbon emissions in a combined analysis of all four sites (see Figure 26 in Appendix A). The FIA site showed high black carbon emissions from the Ambassador Bridge (Figure 26 in Appendix A). The analysis at Newberry indicates that an intermodal freight terminal in the area emits higher concentrations of both OC and black carbon (similar to EC but uses a different analytical method to determine concentration) than the surrounding areas (see Figure 27 in Appendix A). Thus trains, trucks and cars may be an important source of these pollutants. However, these increases are relative to the surrounding areas and may only be a few tenths of a microgram increase. It is important to note that annual average concentrations at these two sites are currently below the standard (see Table 8 in Appendix A). Also, EC tends to be a very small fraction of the total $PM_{2.5}$ mass. Overall, there are still many unanswered questions with OC and more needs to be done to identify the source(s) of OC excess at Dearborn, how they have changed over time, and if necessary, how they can be controlled in the future.

9.5 Modeling

For the purpose of weight of evidence, photochemical and dispersion modeling support the MDEQ assessment that attainment of the annual $PM_{2.5}$ standard will be achieved by 2010 at the monitors currently exceeding the standard, and that monitors that are meeting the standard will remain in attainment of the annual standard. The most recent combination of photochemical and local scale modeling shows attainment of the standard at the highest monitor (Dearborn) by 2009. Details of these analyses follow.

9.5.1 Photochemical Modeling

Extensive photochemical modeling (CAMx) has been conducted by LADCO to address $PM_{2.5}$, as well as ozone and haze in Michigan. A comprehensive Technical Support Document (TSD) describes the modeling parameters, the testing of the model itself, and the predicted reductions in these pollutants in future years. An electronic version of the document is available at http://ladco.org/Technical_Support_Document.html. Section 3 of the TSD describes the model and inputs, and Section 4 provides the modeled future year $PM_{2.5}$ levels for the state.

Table 10 (see also Table 1 in Appendix A) in the TSD shows the modeled $PM_{2.5}$ levels at several monitors in Wayne County, Michigan (not including the impact of local controls). The two highest monitors, Dearborn (261630033) and SWHS (261630015), have 2009 values of 15.8 ug/m^3 and 14.2 ug/m^3, respectively, in the Round 5 modeling.

Of the two modeling scenarios, Round 5 is a more recent version than Round 4, with Round 5 using a base year of 2005 and Round 4 using a 2002 base year. Other upgrades to the model and inventory were also made in the Round 5 modeling (see below for a summary and section 3.3 of the TSD for more details).

Base M/Round 5 (2005)	Base K/Round 4 (2002)
• CAMx v4.50	* CAMx 4.30
• CB05 gas phase chemistry	* CB-IV with updated gas-phase chemistry
• SOA chemistry updates	* No SOA chemistry updates
• AERMOD dry deposition scheme	* Wesley-based dry deposition
• ISORROPIA inorganic chemistry	• ISORROPIA inorganic chemistry
• SOAP organic chemistry	• SOAP organic chemistry
• RADM aqueous phase chemistry	• RADM aqueous phase chemistry
• PPM horizontal transport	• PPM horizontal transport

In addition, the models used different sets of meteorological (MET) data for the two modeling scenarios. Both 2002 and 2005 had above-average ozone-conducive days, but 2002 was more severe than 2005. The relationship between meteorology and $PM_{2.5}$ is not well understood, but it likely influences $PM_{2.5}$. Overall the models show good agreement in magnitude of $PM_{2.5}$ mass, but some species are overestimated and others are underestimated. In 2002, sulfates had good agreement, but nitrates were overestimated in winter. In 2005, sulfates are underestimated but nitrates had good agreement. In both years, OC is still largely underestimated.

While both 2005 and 2002 are considered “SIP quality,” which base year used is a policy decision. The MDEQ has chosen to use the Round 5, 2005 emissions inventory since it is more recent and more accurately reflects actual conditions and emissions changes. Also the 2005 modeling base year more closely predicts the actual annual averages from the air quality monitors.

The Round 5 modeling demonstrated that all monitors with the exception of the Dearborn monitor show attainment by the 2010 attainment date. The Dearborn monitor is further evaluated using local scale modeling described below, which shows that the local scale emission reductions at Severstal will bring the Dearborn monitor value to15.1 ug/m^3 by the 2010 attainment date.

9.5.2 Local Scale Dispersion Modeling

As a complement to LADCO's CAMx, the MDEQ conducted local scale dispersion modeling to determine the impacts of localized emission reductions at large industrial facilities in the vicinity of the air monitors showing violations of the standard. This modeling showed approximately 0.73 ug/m^3 annual reduction in $PM_{2.5}$ at the Dearborn monitor as a result of the controls required at Severstal. Additional reductions are attributed primarily to the locomotive controls and controls installed at Marathon and U.S. Steel.

The local scale modeling is a key to determining impacts of local controls on the nearby monitors that is not accounted for in the CAMx. Predicted impacts from regional grid models such as CAMx cannot account for reductions in close proximity to the monitors because they typically use 36km or 12km grid resolution for SIP attainment demonstrations. Emission reductions from a local area/point source within each grid are "spread out" over the entire grid. Thus, grid models provide useful information concerning regional contributions but fail to adequately address neighborhood scale interactions.

For areas like the Dearborn monitor location, where local source primary emissions may contribute a sizable portion of the total $PM_{2.5}$ (i.e., 10 to 30 percent of the total annual average), use of a Gaussian dispersion model may work well for determining local primary impacts within a small area. Such modeling techniques have become known as local scale, or "hotspot" modeling. Similar to regional scale photochemical grid modeling analyses, the EPA recommends that hotspot dispersion modeling results be used in a relative manner rather than the absolute manner employed in new source review (NSR) permitting analyses. Therefore, that is the approach followed by the MDEQ in this WOE demonstration.

The process to determine neighborhood scale impacts follows the principles suggested in Section 5.3.2 of the EPA's Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze dated April 2007. Similar guidance has been discussed in various regional workshops sponsored by LADCO.

As indicated by Section 5.3.2, there is no single, simple method for quantifying the local contribution to a specific location. In fact, the local component will likely include contributions from more than one source. When applying the model to changes in primary $PM_{2.5}$, the recommended approach is to identify the individual components of $PM_{2.5}$. This approach is necessary so that the non-primary components of $PM_{2.5}$ (i.e., nitrates, sulfates, etc.) can be removed and only the primary portions can be considered. For purposes of this analysis, only the speciated primary components identified as "soil" and "mixed industrials" were considered. These components should contain most of the metals expected from the steel industry plus fugitive emissions associated with large industrial areas.

Local MET data was used to represent the dispersive nature of the Southeast Michigan wind patterns. Meteorology data, collected from the National Weather Service (NWS) at the Detroit Metro Airport, was used for the local scale analysis. To be consistent with the regional scale modeling, 2005 meteorology was utilized. To determine surface characteristics around the Detroit Metro NWS data collection site, the recently released EPA pre-processor (AERSURFACE) was utilized. The results from the AERSURFACE program, which were separated by month over 12 sectors, was supplied to the EPA meteorological pre-processor, AERMET, to create the hourly meteorology data required by AERMOD.

The guidance further recommends that the analysis be done on a quarterly basis. This evaluation deviates from that approach because most of the referenced material was provided on an annual basis. For regional modeling, one reason for performing analyses on a quarterly basis is to account for secondary chemistry variances by season. Since the local scale analysis deals explicitly with primary emissions, seasonal chemistry variances do not apply. Therefore, this deviation from the guidance is not expected to significantly alter the results of this analysis.

The guidance recommends using a relative approach to determine the reductions from planned control strategies rather than absolute model results. This is different from the usual application of results from Gaussian models for regulatory permitting. This is, however, consistent with regional modeling of $PM_{2.5}$, thus is more appropriate for this purpose. The relative reduction factor derived from the 2005 base modeling and the anticipated 2009 emissions was applied to the specified primary component of $PM_{2.5}$ for anticipated reductions.

a. <u>Process for determining impacts of localized emissions reductions.</u>

The methodology used to predict the impacts of required local SIP controls on future $PM_{2.5}$ levels is summarized as follows:

1) Estimate the amount of observed (monitored) $PM_{2.5}$ at the Dearborn monitor that is local in origin.
2) Model base year $PM_{2.5}$ emissions (PM_{10} if $PM_{2.5}$ emissions data is unavailable) from local point sources to determine the impact on the Dearborn monitor.
3) Calculate the amount of observed $PM_{2.5}$ at the Dearborn monitor that comes from Severstal.
4) Model future year (2009) $PM_{2.5}$ emissions from Severstal to determine impact on the Dearborn monitor.
5) Calculate the relative reduction factor for 2009 emission reductions at Severstal.
6) Calculate the predicted $PM_{2.5}$ reduction at the Dearborn monitor in 2009 as a result of SIP controls at Severstal.

1) Local impacts.

To confidently apply a dispersion model in an attainment test, it is first important to determine the local component of the monitored primary $PM_{2.5}$. For this analysis, it is important to identify the local contributions from as small an area as possible to ease identification of the likely contributing sources.

For purposes of this WOE demonstration, three monitoring sites in the area of Southeast Michigan with the highest $PM_{2.5}$ levels were reviewed: Dearborn, SWHS, and Allen Park.

Dearborn monitor

The Dearborn monitor consistently records the highest values of $PM_{2.5}$ in Southeast Michigan, making it the primary monitor of concern. The 2000-2004 weighted average (i.e., the average of the three 3-year averages from those years) is 19.3 ug/m^3. As seen in Figure 28 in Appendix A, the monitor resides approximately 1,000 yards northeast of the Severstal steel mill. This is the direction of the climatic prevailing wind direction (Figure 29 in Appendix A). Between the steel mill and the monitor lies a major rail switching yard that has approximately 19 to 30 trains per day being operated within the yard. Approximately 16 engines will be idling in the rail yard at any given time. The Ford Motor Company Rouge Complex is located just north of the Severstal facility. Another steel company, U.S. Steel, is located on Zug Island, approximately three miles southeast of the monitor. Additionally, a major gasoline refinery, Marathon, is located approximately two miles south of the monitor. Figure 30 in Appendix A shows the relationship of the monitor to these influencing facilities. $PM_{2.5}$ filters collected at the Dearborn monitor are analyzed for particle speciation. This monitor has the highest $PM_{2.5}$ levels in the nonattainment area and is key to demonstrating attainment. It will become the primary point of reference in this WOE demonstration.

SWHS monitor

The SWHS monitor is 2.2 miles east of the Dearborn monitor and approximately one mile north of the U.S. Steel facility on Zug Island (Figure 30 in Appendix A). With the predominant southwest winds (Figure 29 in Appendix A), this location is also vulnerable to emissions from U.S. Steel, Severstal, and Marathon. The 2000-2004 weighted average is 17.3 ug/m^3. Speciated $PM_{2.5}$ data is not available from the SWHS site.

Allen Park monitor

The Allen Park Monitor is located approximately six miles southwest of the Dearborn monitor (Figure 30 in Appendix A). Due to the prevailing winds (Figure 29 in Appendix A), the Allen Park monitor is located upwind of the majority of facilities that likely impact the Dearborn and SWHS monitors during southwest winds episodes. The 2000-2004 weighted average is 15.8 ug/m^3. Due to the upwind nature of the Allen Park monitor location, this monitor can provide more of a regional aspect of Southeast Michigan as compared to the Dearborn and SWHS monitors, which receive a large local component of primary $PM_{2.5}$. Filters collected at the Allen Park monitor are analyzed for particle speciation.

Dearborn vs. Allen Park monitor analysis

Comparison of the particle speciation at Allen Park and Dearborn monitors provides helpful information on the local sources impacting the Dearborn monitor. Several reports analyzing the Dearborn and Allen Park filters have been funded through LADCO. Data from the reports were heavily relied upon for this portion of the WOE demonstration. This section of the WOE relied primarily on source apportionment analysis of the two monitors by STI (2006) and Clarkson University. These reports, in their entirety, are available at the LADCO web site--see references for the web address. It should be noted that additional reports are also available from LADCO. Some of these reports contain additional analysis through 2006.

Based on the differences between the 2000-2004 weighted average contribution at Dearborn (19.3 ug/m^3) and Allen Park (15.8 ug/m^3), first conclusions suggest a maximum of 3.5 ug/m^3 of $PM_{2.5}$ impacting Dearborn are from local sources. This conclusion is supported by the STI (2006) report "Data Analysis and Source Apportionment of $PM_{2.5}$ in Selected Midwestern Cities," November 2007, which states that, "…the Allen Park site does not seem to be influenced by sources in the Dearborn area…" (page 3-10).

It is possible that the 3.5 ug/m^3 value is an overestimation of local impacts because there are likely sources that impact both monitors. A comparison of the results from the following reports provides a more realistic estimate of local contribution to the Dearborn site. The difference between the combined soil and mixed industry at Allen Park (2.23 ug/m^3) and Dearborn (4.55 ug/m^3) is 2.32 ug/m^3 in the Clarkson report (see Table 9.5.a). The difference between the combined soil and mixed industry at Allen Park (1.98 ug/m^3) and Dearborn (4.36 ug/m^3) is 2.38 ug/m^3 in the STI (2006) report (see Table 9.5.a).

Table 9.5.a: Comparison of Clarkson and STI source apportionment results (in ug/m^3).

	Clarkson Report			STI Report	
	Allen Park (2001-2003)	Dearborn (2002-2003)		Allen Park (2002-2004)	Dearborn (2002-2005)
Sulfate	5.10	8.00		4.51	4.49
Nitrate	3.40	3.98		4.16	4.26
Soil	0.98	2.23		0.63	0.88
Aged Sea and Road Salt	0.46	0.46			
Spark-ignition Vehicles	3.70	4.07		3.53	3.96
Diesel Vehicles	0.84	1.13		2.37	1.06
Biomass Burning	0.37				0.31
Mixed Industrial	1.25	2.32		1.35	3.48
Local Primary Particulate Soil + Industrial	2.23	4.55		1.98	4.36
Dearborn - Allen Park	**2.32**			**2.38**	

The local contribution of primary $PM_{2.5}$ in the range of 2.30 ug/m^3 to the Dearborn monitor is further supported by additional analysis by LADCO, documented in a presentation titled, "Data Analysis to Support Local Area Modeling," (Kenski, 2007). In Figure 31 in Appendix A from the Kenski report, approximately 3.25 ug/m^3 is associated with the Dearborn monitor while approximately 0.95 ug/m^3 is associated with Allen Park monitor. Subtracting the Allen Park concentration as area background would leave at the Dearborn monitor 2.30 ug/m^3 as local contribution, which is similar to the Clarkson and STI results. It is likely that this is an underestimation since some of the sources contributing to Dearborn also contribute to a small degree to Allen Park.

For purposes of this WOE demonstration, a concentration of 2.30 ug/m^3 of primary fine particulate will be considered as nearby local contribution to the Dearborn site (Table 12 in Appendix A).

2) Model base year local source emissions.

The EPA AERMOD Gaussian Dispersion model was used to predict impacts at the monitors of concern. Table 13 in Appendix A provides the significant sources used in the AERMOD model to predict impacts from neighborhood scale emissions (see Figure 3 in Appendix A). Most of the sources were treated as a single individual point source using a weighted, representative stack. Due to the proximity of the Severstal facility, detailed refined modeling used all individual point and volume sources as defined during previous NSR permitting. Actual $PM_{2.5}$ 2002 emissions from Severstal (totaling 553.4 tons/year) were identified by the MDEQ at each detailed emission point. Emissions used from the other sources were PM_{10} emissions as provided by the facility 2002 Michigan Air Emissions Reporting System (MAERS). The total modeled impact at the Dearborn monitor is 4.61 ug/m^3, with 2.96 ug/m^3 coming from Severstal. Emissions from these sources have not changed significantly in the last several years and are considered representative for 2005

3) Calculation of the amount of Severstal $PM_{2.5}$ impacting the Dearborn monitor.

To determine the Severstal impact on the Dearborn monitor, a Relative Reduction Factor was derived based on the modeled values from the local sources. The Severstal predicted impact (2.96 ug/m^3) was divided by the overall predicted impact from all local sources (4.61 ug/m^3) for a Relative Reduction Factor of 0.642. Applying this factor to the previously determined local primary $PM_{2.5}$ contribution to the Dearborn monitor of 2.30 ug/m^3 yields an annual average of 1.48 ug/m^3 contributed by Severstal to the Dearborn monitor.

4) Modeled impact of 2009 Severstal emissions on the Dearborn monitor.

The AERMOD model was run using the 2009 Severstal projected emissions. The emission total is reduced by 148 tons of $PM_{2.5}$ from the 2002 level because of the various controls that the company is installing. The inventory list is summarized in Table 2 of the Appendix A. The 2009 Severstal impact was predicted by AERMOD to be 1.47 ug/m^3.

5) Calculation of the Relative Reduction Factor.

The 2009 impact was predicted to be 1.47 ug/m^3 as compared to the 2002 base case impact of 2.96 ug/m^3. This provides a Relative Reduction Factor of 0.497 (i.e., 1.47 / 2.96 = 0.497).

6) Calculation of the reduction in ug/m^3 at Dearborn in 2009 because of Severstal controls.

The reduction in observed values at the Dearborn monitor in 2009 resulting from reductions at Severstal is calculated by multiplying the relative reduction factor of 0.497 by the predicted Severstal contribution of 1.48 ug/m^3 in 2002. Therefore the expected reduction by 2009 will be 0.73 ug/m^3 based only on Severstal reductions. Table 9.5.b summarizes these figures. It should be noted that this is a conservative prediction because other emission reductions in the area from U.S. Steel, Marathon, locomotive retrofits, and other sources have not been accounted for in this calculation and will further contribute to reductions at the Dearborn monitor.

b. <u>Modeled local control strategies.</u>

The LADCO analysis (Figure 13 in Appendix A) provided evidence that iron accounts for approximately 1.4 ug/m^3 of primary particulate to the Dearborn monitor.

Iron is associated primarily with steel production, and most can be attributed to Severstal. Table 13 in Appendix A indicates that U.S. Steel contributes only slightly to Dearborn compared to Severstal. As such, based on the annual emissions, prevailing winds, and close proximity, it can be reasonably assumed that Severstal contributes the majority of excess $PM_{2.5}$ which is not seen at other area monitors. As provided in the previous section, the assumption that Severstal contributes 1.48 ug/m^3 to the Dearborn monitor is likely an underestimation, as conservative assumptions are applied at each step of this analysis.

Table 2 in Appendix A lists 2002 emissions from the permit application inventory and 2009 projected emissions. It is believed that the 2002 emissions closely resembles 2005 emissions. As shown by the total emissions reductions, Severstal will reduce emissions by installing new particulate controls on two blast furnaces, the basic oxygen furnace and several other smaller operations in the facility. The sum of the reductions will be 148 tons per year. These reductions were not taken into account during the regional modeling performed with CAMx. Thus, double-counting should not be an issue.

The AERMOD model was run using the 2009 Severstal projected emissions. The new **2009 Impact** was predicted to be 1.47 ug/m^3 as compared to the **2005 Base Case** impact of 2.96 ug/m^3. This provides a Relative Reduction Factor (**RRF**) of 0.497 (i.e., 1.47 / 2.96 = 0.497). Applied to the monitored **2002 Contribution** by Severstal (1.48 ug/m^3), the expected Severstal reduction by 2009 will be 0.73 ug/m^3. Table 9.5.b summarizes these figures. This reduction in primary particulate from Severstal, in conjunction with the regional 2009 prediction of total $PM_{2.5}$ particulate (15.8 ug/m^3), indicates that Dearborn will be nearly in attainment by 2009 even before considering other reductions of neighborhood scale emissions.

Table 9.5.b: Severstal's 2009 contribution to the Dearborn monitor

2005 Base Case: Predicted AERMOD Severstal Contribution to Dearborn	2.96	ug/m3
AERMOD Total: AERMOD Neighborhood Scale Contribution to Dearborn	4.61	ug/m3
Relative Factor: Severstal Relative Factor *(2005 Base Case / AERMOD Total)*	0.642	
Total: MONITORED Neighborhood Scale Contribution to Dearborn Monitor	2.30	ug/m3
2002 Contribution: Severstal's 2002 Contribution to the Dearborn Monitor *(Total x Relative Factor)*	1.48	ug/m3
2009 Impact: Predicted AERMOD Severstal Contribution to Dearborn	1.47	ug/m3
RRF: Relative Reduction Factor *(2009 Impact / 2002 Base Case)*	0.497	
2009 Severstal Reduction to Dearborn Impact *(RRF x 2002 Contribution)*	**0.73**	**ug/m3**

c. <u>AERMOD dispersion model validation.</u>

The hotspot dispersion modeling results can be evaluated to address model performance. Similar to grid modeling, the dispersion model results should be compared to ambient data to ensure the model is working well.

As discussed in the previous section, combined soil (including metals) and mixed industrial impacts at the Dearborn monitor were concluded to be 4.55 ug/m^3 per the Clarkson report and 4.36 ug/m^3 per the STI report. Table 13 in Appendix A provides overall combined impacts and individual contribution for each source near the Dearborn monitor based on the AERMOD modeling. The combined near source industrial emissions were predicted to yield an impact of 4.61 ug/m^3 at the Dearborn monitor. This close comparison to the Clarkson and STI values suggests that the emissions estimates and dispersion model are doing a reasonable job addressing the local component of primary $PM_{2.5}$ from nearby industrial sources.

The model further gives a combined impact from these sources of 0.65 ug/m^3 at the predominantly upwind Allen Park monitor. This minimal impact is expected because of the location of the monitor in relation to the sources. This also follows the STI assumption that, "…the Allen Park site does not seem to be influenced by sources in the Dearborn area…" (page 3-10).

The AERMOD modeled impact at the SWHS monitor (2.59 ug/m^3) from the same sources is less than the modeled impact at Dearborn (4.61 ug/m^3) for the same emission sources. This is expected because of the larger distance between the sources and SWHS. The Dearborn minus SWHS modeled difference, 2.02 ug/m^3 (4.61 ug/m^3 - 2.59 ug/m^3) is similar to the monitored 2000-2004 weighted average difference of 2.0 ug/m^3 (19.3 ug/m^3 - 17.3 ug/m^3).

In all cases, some AERMOD overprediction is expected because all source emissions, except Severstal, assumed PM_{10} emissions will be higher than $PM_{2.5}$ emissions. Table 12 in Appendix A provides a summary of the Dearborn minus the Allen Park industrial particulate differences.

AERMOD modeling summary files for the 2005 and 2009 analyses are attached as Appendix H.

9.5.3 Combined Modeling Results

The impacts of future year emission reductions, taking into account future year growth as well, is demonstrated by combining the regional scale photochemical modeling with the local scale modeling. To avoid double counting of emission reductions, the modeled local source emission reductions are not accounted for in the regional modeling inventory. The future year predicted $PM_{2.5}$ levels as determined by the regional modeling is included in Table 10 in Section 4 of the LADCO TSD (see also Table 1 in Appendix A). The values for the two monitors that are showing violations of the standard in Michigan, in micrograms per cubic meter, are as follows:

Monitor	2009 (regional)	2009 (local)	2009 predicted level
Dearborn	15.8	0.73 reduction from Severstal	15.07
SWHS	14.2	Not calculated	Less than 14.2 expected

The predicted $PM_{2.5}$ impact at the Dearborn monitor in 2009 resulting from primary $PM_{2.5}$ emission reductions at Severstal is a reduction of 0.73 ug/m^3. When this reduction is subtracted from 15.8 ug/m^3 as projected from the regional modeling, the resulting calculated $PM_{2.5}$ level at the Dearborn monitor in 2009 is predicted to be 15.07 ug/m^3. With the $PM_{2.5}$ standard at 15 ug/m^3, this modeling demonstration provides additional support for attainment by 2010. While the modeled value is slightly over the standard, the AQD believes that the additional reductions from locomotive retrofits and other local sources described in section 10 of this document will ensure that the Dearborn monitor and the entire nonattainment area will come into attainment by 2010.

10. Attainment Strategy

The attainment strategy approach for fine particulate should be multifaceted. There are four components to the attainment strategy for $PM_{2.5}$:

1. Implementation of national controls;
2. Implementation of local controls;
3. Voluntary measures, and;
4. Areas of continued study.

This multifaceted strategy is based on lessons learned from our technical analyses as reflected in the WOE demonstration. No single program can be relied upon for attainment and our limitations in predicting the future through the use of air pollution models, travel models, and economic models, are recognized in this multifaceted attainment strategy.

Acknowledging that some activities that will contribute to air quality improvement and attainment do not necessarily lend themselves to regulatory action and that controls in certain parts of the nonattainment area will contribute very little toward attainment, the strategy targets local controls in a portion of eastern Wayne County. This is consistent with the location of violating monitors and with earlier successful strategies in attaining previous particulate matter standards.

10.1 Implementation of National Controls

a) Mobile Sources

Mobile sources are recognized as a significant contributor to $PM_{2.5}$ levels in both attainment and nonattainment areas. The focus on reducing emissions cost-effectively in the eastern portion of Wayne County is somewhat incompatible with specialized vehicular emission reduction programs. More importantly, the contribution of mobile sources to $PM_{2.5}$ levels will be reduced throughout the region and nation as a result of several new federal requirements. These requirements affect both vehicle design as well as fuel specifications. We estimate the following programs will reduce $PM_{2.5}$ mobile source emissions by over 51 percent between 2002 and the attainment year, 2010.

> **Tier 2 emission standards**: We expect significant reductions in mobile source emissions from implementation of the Tier 2 program. The Tier 2 program requires manufacturers to produce vehicles that emit much lower levels of pollution than earlier generations. Because this is a national program, these reductions from “on-board” controls will be occurring in Southeast Michigan as well as in upwind areas. Consequently, transport into the region will be reduced.

Diesel Rule: Similarly, the EPA estimates its new Diesel Rule will result in a 97 percent reduction in emissions from heavy-duty diesel trucks. As with gasoline vehicles, these reductions will occur throughout the entire country.

Low sulfur gasoline and diesel fuel: Beginning in 2004, refineries began phasing in a new sulfur levels for gasoline due to new federal standards for fuel. This standard requires the average sulfur level to be no greater than 30 parts per million (ppm). This represents a 14-fold reduction in Southeast Michigan where average levels in 2002 were 430 ppm. Also beginning in 2006, a new requirement for ultra low sulfur diesel fuel (15 ppm) will begin phasing in. As with gasoline, this represents an enormous decrease from the 380 ppm average measured in 2002.[3] These sulfur reductions are a key contributor to the large-scale vehicular emission reductions shown in Figure 2 of Appendix A.

Although these low sulfur fuel programs are federal requirements, the Michigan Department of Agriculture (MDA) is committed to testing for compliance with these standards. The MDA will update its existing programs and regulations to include a provision for the enforcement of these standards.

Implementation of this program and enforcement of this program is primarily the responsibility of the EPA. Using a combination of its enforcement authority under the Clean Air Act and its program for certifying manufacturer compliance with vehicle emissions standards, the EPA is a key partner in implementing this facet of the control strategy.

b) Stationary Sources

Clean Air Interstate Rule: In 2005, the EPA finalized a rule to address long-range transport of $PM_{2.5}$, commonly referred to as the CAIR rule. This rule will result in major reductions of sulfates and nitrates, two of the most significant contributors to $PM_{2.5}$ at monitors showing violations of the standards and throughout the nonattainment area. The MDEQ has primary responsibility for ensuring that required emission reductions are implemented. The MDEQ is committed to ensuring these reductions occur as scheduled in the national rule.

10.2 Implementation of Local Controls

a) Severstal steel production facility

Two enforceable programs have already been put in place to secure emission reductions that are a key component of the $PM_{2.5}$ attainment strategy. One is a recently approved consent order between Severstal and the MDEQ. The other is a

[3] Alliance of Automobile Manufacturers. 2002 North American summer and winter fuel surveys.

recently approved permit that is subject to the consent order. These programs require emission reductions from the following sources:

- Basic Oxygen Furnace (BOF): Install baghouse.
- Blast furnace C: Install baghouse.
- Blast furnace B: Install baghouse or shutdown by June 2008.
- Torch cutting: No longer permitted on site.
- Scarfing operations: Reduce opacity.
- Torpedo cars: Reduce smoking.

The combined impact of these controls is expected to reduce annual primary $PM_{2.5}$ emissions by 147 tons/year, and will be especially critical in reducing the excess iron identified in our technical analysis (MDEQ PTI #182-05B--see Tables 2 and 3 in Appendix A and Appendix F, and Appendix J).

Furthermore, a Supplemental Environmental Project requires Severstal to take the following additional actions:

- School bus retrofits: The Company will spend $100,000 to retrofit approximately 100 school buses in the local area with diesel oxidation catalysts and/or engine crankcase filters. These devices will reduce the exposure of children to diesel particulate emissions as well as reduce overall $PM_{2.5}$ emissions in the area.
- Company-owned diesel equipment retrofits: The Company will spend $100,000 to retrofit some of its own on-site diesel equipment.
- Planting of trees in the area: The Company will spend $200,000 on tree planting in the area, providing both air quality and aesthetic benefits.

b) U.S. Steel

An enforceable consent order and permit between the company and the MDEQ resulted in reductions at the B blast furnace. The existing baghouse was replaced resulting in an annual primary PM emissions reduction of 76 tons (Consent Order #1-2005, ROP #199600123a--see Table 3 in Appendix A).

c) Marathon

An enforceable consent order and permit at Marathon also resulted in $PM_{2.5}$ emission reductions. These reductions resulted from the following specific actions that are currently being implemented:

- Fluid Catalytic Cracking Unit (FCCU): Company is adding an electrostatic precipitator (ESP) and catalyst additives.
- CO Boiler: Has been shut down.
- Crude/Vac Heater: NOx Controls.
- BT Inter Heater and BT Charge Heater: NOx reductions.

The combined impact of these controls reduced annual primary PM emissions by 94 tons/year.

Marathon has also applied for a permit to install a coking unit to process heavy crude oil. The proposed permit is currently in the public comment phase of the permitting process; however, if the permit is successfully completed, the company will marginally reduce PM and its precursors. In addition, pending permit approval, Marathon is planning several other air quality actions (MDEQ PTI #388-07--see Table 3 in Appendix A).

- Voluntary retrofit of school buses in the City of Detroit fleet.
- Voluntary enhanced street sweeping on public roads in the vicinity of the plant.
- Voluntary installation of air monitoring stations in and around the facility.
- Voluntary installation of particulate controls on the truck fleet that will transport petroleum coke.
- Voluntary purchase of PM_{10} offsets from closed plants to retire.

d) Reductions from plant closures and changes in operations

As discussed in the WOE, $PM_{2.5}$ levels are improving. The rate of improvement is greater at the industrial monitoring sites (Dearborn, SWHS, and Wyandotte). While local regulatory measures were not responsible for this improvement, many of these reductions are permanent and the impact on attainment and maintenance is significant.

e) Diesel Switch Engine Locomotive Retrofits

In the course of identifying possible sources for emission reductions, we also considered factors beyond the quantity of emissions. These include the nature of the emissions and proximity to the Dearborn and SWHS monitors and surrounding communities. Approximately 40 switch engines operate in these areas on a fairly continuous basis with little or no emission control. Over the next two years, 28 of the switch engines in this area will be retrofitted with anti-idling equipment. Based on data from a similar project in Chicago (USEPA 2004), this initiative is expected to reduce NOx emissions by 67 tons/year and PM by 2 tons per year. In addition, four to six switch engine locomotives at the CSX rail yard immediately adjacent to the Dearborn monitoring site will be rebuilt with smaller engines over the next two years, resulting in an annual emissions reduction of at least 66 tons of NOx and 1.8 tons of diesel PM. This brings the total annual reduction from these retrofits to 132 tons of NOx and 3.8 tons of diesel PM.

10.3 Voluntary measures

a) High emitting vehicle detection

Despite the massive reductions in vehicular emissions as a result of on-board controls and cleaner fuels, a small portion of the vehicle population contributes disproportionately to the total amount of these emissions. Because of the cost, effectiveness, and time to implement a mandatory vehicle-testing program, this measure is not being pursued. Furthermore, a large number of vehicles that operate in the region are not registered in the area and are merely passing through. Thus, they would not be subject to the test.

Nonetheless, advances in technology make it feasible to sample vehicle emissions in-situ using a remote sensing device. SEMCOG recently completed a project to identify the number and characteristics of high emitters in the region. The project showed that Southeast Michigan has fewer high emitters than other parts of the country due to its newer fleet. However, the study also showed that 10 percent of the fleet contributes 70 percent of the emissions. Thus, reducing the number of high emitters has significant emission reduction potential. The project included contacting owners of high emitting vehicles and encouraging them to voluntarily seek repairs. Roughly 40 percent of those contacted did seek repairs, which shows great promise for a broader voluntary program. The vast majority of those who did not seek repairs said they could not afford them. SEMCOG is pursuing follow-up activities to make the public aware of the high emitter issue with a goal of reducing the number of high-polluting vehicles on the road.

b) Fugitive Dust Reduction

In the course of MDEQ's technical analysis, a large number of storage piles, unpaved lots, and plots of barren land were observed within a three-mile radius of both the Dearborn and SWHS monitors (see Figure 9 in Appendix A). The vast majority of emissions from these "fugitive" sources are thought to be larger than $PM_{2.5}$. Nonetheless, the sheer number of them, and their possible aggregate impact, deserves attention. While many of these sources are already the subject of a regulatory program as the result of a previous SIP, voluntary programs, targeted at smaller establishments in the area, may produce additional benefits and should be explored.

To that end, SEMCOG has teamed with Southwest Detroit Environmental Vision and a graduate class at the University of Michigan (U of M) to develop a blueprint for greening properties in this area. During the 2007-2008 academic year, the U of M students will be researching different plant species that could have the greatest potential for reducing dust in the area, the locations where planting could be most advantageous, and ways that such landscaping could be marketed to businesses in the community as well as other potential funding organizations.

While the precise impact of this initiative on fine particulate concentrations in the area is unknown, implementation of such a greening program will certainly improve the overall environment for the people who live and work in the area.

10.4 Tracking Progress and Continuing Evaluation

Another part of the multifaceted approach to the $PM_{2.5}$ strategy involves tracking progress toward attainment and continued evaluation of other possible contributors that should be the subject of control. This differs from the traditional approach to SIP development but is consistent with the weight of evidence on which this strategy is based. Specifically, instead of presuming that attainment will occur exactly as planned, this section includes a course of action, tracking progress, and identifying other contributors that should be subject to control. Each of these elements is discussed below.

a. **$PM_{2.5}$ Monitoring Network Enhancement –** In order to improve our understanding of the $PM_{2.5}$ nonattainment problem in Southeast Michigan, particularly with regard to individual species, enhancements to the current monitoring network are needed. Appendix E is a draft strategy for improving the monitoring network in this region, provided the MDEQ can obtain additional funding. These enhancements will not only improve our understanding of current $PM_{2.5}$ concentrations, they will also allow us to better track progress towards attainment.

b. **Organic Carbon Analysis –** While the controls listed in sections 10.1 to 10.3 above will have a significant impact on $PM_{2.5}$ in Southeast Michigan, more needs to be done to understand and address the excess OC component. Much time and effort has been spent analyzing available OC data. However, the lack of speciated data at many monitoring locations and the relatively short history of monitoring data make it difficult to identify the source(s) of these emissions. Additional studies will be pursued to increase our understanding of this component and its contribution to Southeast Michigan's fine particulate problem.

11. RACT and RACM

Rule 40 CFR Part 51.1010 requires the MDEQ to submit with the attainment demonstration a SIP revision demonstrating that it has adopted all RACM (including RACT for stationary sources) necessary to demonstrate attainment as expeditiously as practicable. RACM is the application of reasonable controls on sources in a nonattainment area to expedite the attainment of the area. RACT is a subset of RACM; the application of such controls specifically on stationary sources. For areas that are projected to attain by 2010, RACT and RACM are not needed because they will not result in more expeditious attainment.

The MDEQ's $PM_{2.5}$ SIP has been developed to demonstrate through a weight of evidence approach that the nonattainment area will attain the standard by 2010 through a combination of multistate regional controls and reductions at several sources in close proximity to the areas with the highest $PM_{2.5}$ annual levels. Additional area-wide controls more reflective of RACT and RACM are not believed to be appropriate for addressing the $PM_{2.5}$ problems at the violating monitors in Southeast Michigan.

However, before making the decision not to pursue RACT controls, the MDEQ did perform a modeling screening evaluation of the impacts that large emission reductions would have on the violating monitors, as described in Section 11.1 below. The results of the modeling, of 0.49 ug/m^3 for statewide reductions and 1.01 ug/m^3 for 7 county reductions at the Dearborn monitor are not insignificant. However, a very large emission reduction in the multicounty area and statewide, clearly a draconian control program, would be required to achieve such reductions. Thus, a RACT and RACM program, being "reasonably available" by definition, would be expected to provide much smaller emission reductions and therefore much smaller improvements in $PM_{2.5}$ levels at the violating monitors.

The MDEQ took one further step in evaluating RACT by evaluating the sources likely impacted by such a program. Parts 11.2 through 11.4 below contain details on the point sources of SO_2, NOx, and primary $PM_{2.5}$ in the 7-county area along with information necessary in the event that RACT control programs for these sources were instituted in the area. This analysis further demonstrates that a RACT program addressing stationary sources would result in much smaller emissions reductions than were modeled in the screening modeling. The conclusion from this is that such control programs would have little impact on reducing $PM_{2.5}$ levels at the violating monitors.

11.1 RACT-RACM modeling

To determine the impacts of additional NOx and SO_2 reductions on $PM_{2.5}$ monitors, two sensitivity tests were performed with the CAMx model.

The first test reduced ALL statewide anthropogenic sources of NO, NO_2, and SO_2 emissions by 50 percent. Utility software provided by LADCO allowed the combined emission inventory (all point sources plus all area sources) to be reduced by 50 percent across the entire state of Michigan. The CAMx model was run using the modified emissions files containing the statewide reduced emissions and compared results to the unaltered 2005 base case (Base M emissions inventory). The relative results were used to determine what effect such a draconian cut in emissions would make to sensitive monitors through the State of Michigan. In this test, the Relative Reduction Factor (RRF) was 0.973 at the Dearborn monitor, which yielded an approximate annual reduction of 0.49 ug/m^3 using 2005 monitored values (Table 11.1.a).

The second test involved eliminating ALL (i.e., 100 %) of the anthropogenic NO, NO_2, and SO_2 emissions in the 7-county nonattainment area of Southeast Michigan. The CAMx model was again run using the altered emissions files containing the modified 7-county emissions and compared results to the unaltered 2005 base case (Base M emissions inventory). The relative results were used to determine what effect such additional draconian cuts in emissions would make to sensitive monitors through the State of Michigan. In this test, the RRF was 0.945 at the Dearborn monitor which yielded an approximate annual reduction of 1.01 ug/m^3 using 2005 monitored values (Table 11.1.b).

While the Dearborn monitor reductions of 0.49 ug/m^3 (e.g., 50 percent statewide cuts) and 1.01 ug/m^3 (100 percent 7-county cuts) are significant, it is clear that this level of reduction compared to the massive emissions cuts assumed in these analyses could not be justified and are not likely attainable. Such a costly control program would be very difficult to implement in an area like Detroit that has been in an economic recession for years.

Table 11.1.a: Statewide RACT-RACM run results.

MICHIGAN RACT-RACM ANALYSIS

(ASSUMES 50% NOx/SO_2 CUTS STATEWIDE - ALL SOURCES)

MICHIGAN MONITORS	2005 Monitored ug/m3	RRF	2005 w/MI RACM ug/m3	Net Reduction ug/m3
Lansing	13.54	0.944	12.78	**0.76**
Jenison	13.99	0.950	13.29	**0.70**
Grand Rapids	13.72	0.950	13.03	**0.69**
Holland	12.39	0.945	11.71	**0.68**
Port Huron	15.09	0.964	14.55	**0.54**
Bay City	12.44	0.957	11.91	**0.53**
New Haven	14.37	0.964	13.86	**0.51**
Saginaw	11.72	0.957	11.22	**0.50**
Muskegon	13.07	0.962	12.57	**0.50**
Dearborn	**18.55**	**0.973**	**18.06**	**0.49**
Kalamazoo	13.83	0.965	13.34	**0.49**
Flint	12.89	0.963	12.41	**0.48**
West Fort	17.21	0.973	16.75	**0.46**
Ypsilanti	15.61	0.971	15.16	**0.45**
Luna Pier	15.70	0.972	15.26	**0.44**
Wyandotte	16.41	0.973	15.97	**0.44**
Livonia	14.94	0.971	14.51	**0.43**
Linwood	16.01	0.973	15.58	**0.43**
Coloma	13.05	0.967	12.63	**0.42**
East 7 Mile	16.48	0.974	16.06	**0.42**
Allen Park	15.94	0.973	15.52	**0.42**
Oak Park	15.46	0.974	15.06	**0.40**
Ann Arbor	13.20	0.971	12.82	**0.38**
Sault Ste Marie	8.16	0.971	7.92	**0.24**
STATEWIDE AVERAGE				**0.49**

Table 11.1.b: 7-county nonattainment area RACT-RACM run results

MICHIGAN RACT-RACM ANALYSIS

(ASSUMES 100% NOx/SO_2 CUTS IN 7-COUNTY SE MICHIGAN - ALL SOURCES)

	Monitored 2005 Base ug/m3	RRF	2005 RACM ug/m3	Net Reduction ug/m3
Dearborn	**18.55**	**0.945**	**17.54**	**1.01**
West Fort	17.21	0.945	16.27	0.94
Wyandotte	16.41	0.945	15.51	0.90
Linwood	16.01	0.945	15.14	0.87
Port Huron	15.09	0.942	14.22	0.87
Allen Park	15.94	0.945	15.07	0.87
New Haven	14.37	0.942	13.54	0.83
Ypsilanti	15.61	0.950	14.82	0.79
Livonia	14.94	0.950	14.19	0.75
Ann Arbor	13.20	0.950	12.54	0.66
East 7 Mile	16.48	0.960	15.82	0.66
Luna Pier	15.70	0.958	15.05	0.65
Oak Park	15.46	0.960	14.84	0.62
Lansing	13.54	0.959	12.98	0.56
Flint	12.89	0.973	12.54	0.35
Bay City	12.44	0.972	12.09	0.35
Kalamazoo	13.83	0.976	13.50	0.33
Saginaw	11.72	0.972	11.39	0.33
Jenison	13.99	0.978	13.68	0.31
Grand Rapids	13.72	0.978	13.42	0.30
Holland	12.39	0.979	12.13	0.26
Coloma	13.05	0.982	12.81	0.24
Muskegon	13.07	0.982	12.84	0.23
Sault Ste Marie	8.16	0.982	8.01	0.15
STATEWIDE AVERAGE				**0.58**

11.2 NOx RACT-RACM Analysis

The MDEQ's NOx RACT analysis began by looking at the 2005 MAERS inventory for all reporting NOx stationary sources in the 7-county $PM_{2.5}$ nonattainment area. The total NOx emissions for these sources are greater than 81,000 tons/year. A cut-off of 50 uncontrolled tons of NOx per year per source was used to isolate those sources that are most likely to be large enough to be impacted by a RACT control program. This grouping of larger sources represents the vast majority of stationary source NOx emissions, at approximately 79,000 tons/year.

This grouping of larger sources was then broken down by major source type, based on operations at each of the stationary sources. A breakdown of the source categories by size is as follows. As expected, the highest emitters are EGUs. The next highest sources group are industrial/ commercial/ institutional (ICI) boilers. The third highest grouping is kilns operated in the area at two sources. The fourth highest is reciprocating internal combustion (RIC) engines, compressors and turbines used in the natural gas industry. Next are the blast furnace emissions at the steel-manufacturing operations in the area. Coming in next is the glass-manufacturing operations. Flares at local landfills and fuel test cells used by the major automotive manufacturers had minimal impacts as well as any remaining miscellaneous sources without any stationary source-specific coherency to be used for RACT controls. See Table 11.2.a.

It should be noted that source reporting to Michigan's emission inventory contained several groupings of units reported as "one" unit; therefore it is hard to determine the exact number of units at each stationary source. For example, a stationary source listed under ICI may have 6 boilers with aggregated emissions greater than 50 tons. NOx controls are on individual units and may not garner the predicted emission reductions as listed in Table 11.2.b.

EGUs

The EGUs are currently regulated under the CAIR and reductions will occur in conjunction with a regional trading program.

ICI Boilers

A review of Council of Industrial Boiler Owners (CIBO) comments and presentations during Ohio's NOx RACT Rule's public comment period, LADCO's ICI Boiler workgroup presentations and a review of information submitted by the Energy and Environmental Analysis, Inc. to the Oak Ridge National Laboratory in May 2005, represented the most common ideas for RACT controls that would typically be used for ICI boilers. The most common for ICI boilers would be low NOx burner combustion controls (LNB) and selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) post combustion controls.

Out of 30 potential ICI stationary sources within Southeast Michigan that could have NOx controls installed, less than 4 percent are currently controlled for NOx. The anticipated level of emission reduction Michigan could achieve in the nonattainment area from affected sources is outlined in Table 11.2.b. Table 11.2.c. provides an assessment of NOx emissions sources that emit more than 50 tons per year.

Regarding the ICI boilers, a workgroup consisting of the states in LADCO and the Ozone Transport Commission and their respective regions is composing a request asking the EPA to create a national rule to reduce emissions from boilers greater than 50 mmBtu/hour heat input rates. If a national rule is implemented it would create consistency among the states as opposed to a patchwork of statewide or nonattainment area-specific control programs.

Kilns
There are two stationary sources with large kilns operating in the area. There is some potential for post-combustion controls on these units as shown in Table 11.2.b.

RIC Engines
Large RIC engines are subject to a Michigan rule (Rule 818) that addresses NOx reduction requirements for these units. There are potential additional reductions available in this category by lowering the threshold level for affected facilities within our rules. This could result in additional NOx reductions as listed in Table 11.2.b.

Furnaces at Steel Mills
Blast and arc furnaces in operation at the steel mills in the area could provide additional controls. Some controls are currently being planned for two of the stationary sources in the area. Additional post-combustion controls would be hard to configure but not impossible. The cost per ton could be higher than what is indicated in Table 11.2.b.

Glass Mfg.
There is one stationary source in the area that manufactures flat glass. This process is combustion and heat intensive. Additional post-combustion controls would be hard to configure but not impossible. The cost per ton could be higher than what is indicated in Table 11.2.b.

Flares at Landfills
Flares at landfills are potential sources of emission reductions. They are used to vent the build-up of methane gases within the landfill. It could be dangerous, due to explosion hazards, to add on post-combustion controls. The EPA created the Landfill Methane Outreach Program (LMOP) in 1994 to reduce methane emissions from landfills. Twenty-seven landfills in Michigan currently utilize the methane gas generated to produce electricity. The EPA has a landfill gas energy cost model that can be used to evaluate the economic feasibility of a landfill gas energy project. However, specific reductions are not well known or published at this time.

Fuel Test Cells
Fuel test cells are used by auto manufacturers to test the automotive engines using gasoline and diesel fuel, as appropriate. The largest emitting sources in this area control their VOC emissions with thermal oxidizers that are creating high NOx emissions. Controlling the VOC control equipment could be the only option for NOx control. This would entail adding post-combustion controls to a thermal oxidizer and may not be technically feasible. Due to the high temperatures of the exhaust gases from the oxidizer, sources would need to “cool-down” the gas stream prior to entry into post combustion controls such as SCR or SNCR. If the temperature of the exhaust gas entering the post-combustion controls is too high, it could result in corrosion of the equipment or fouling of the catalyst. The additional cost for piping and other equipment to cool the exhaust gas stream is undetermined at this time,

but warrants future review as more data becomes available. Additionally, not all the fuel test cells currently have VOC controls and requiring additional NOx control may result in less VOC controls being used.

Table 11.2.a. NOx Tons and Percentages by Emission Source

Sources	NOx Emissions in Tons*	Percentage of Total Tons
EGUs	61,811	78
ICI Boilers	7,942	10
Kilns	3,028	4
RIC Engines	2,429	3
Furnaces at Steel Mills	1,970	2.4
Glass Mfg.	1,515	1.9
Flares at Landfills	500	0.6
Fuel Test Cells	117	0.1
Totals	79,312	100%

* Values have been rounded.

Table 11.2.b. Percent Reduction and Dollar per Ton of NOX Reductions

Cost Per Ton*	Percent Removed	Control Type	Tons of NOx Reduced						
			Landfill Flares	Fuel Test Cells	ICI	Kilns	RIC	Fur-naces	Glass Mfg.
$700.00	40%	LNB	NA	NA	3,177	NA	NA	NA	NA
$1,200.00	80%	SCR	NA	NA	6,354	2,422	1,943	1,576	1,212
$1,500.00	50%	SNCR	NA	NA	3,971	1,514	1,214	985	757

* Cost per ton values were based on EPA estimates as presented by Black & Veatch on December 2005

Note: The ICI boilers were the only units considered for combustion controls. ICI, RIC, kilns, furnaces at steel mills and glass manufacturing operations were considered for post-combustion controls. The remaining sources are not easily controlled.

Table 11.2.c. NOx Emission Sources in Southeast Michigan*

County	SRN	Name	Tons
		Engine Testing	
WAYNE	N6327	FEDERAL- MOGUL POWERTRAIN, INC.	63.78
WAYNE	B6230	FORD MOTOR CO RESEARCH &DEV CTR	53.92
		Glass Mfg.	
MONROE	B1877	GUARDIAN INDUSTRIES	1,515.67
		Recip Internal Combustion	
LIVINGSTON	N5572	HOWELL COMPRESSOR STATION	716.98
SAINT CLAIR	B6478	BELLE RIVER COMPRESSOR STATION	567.82
SAINT CLAIR	B6481	MID MICHIGAN GAS STORAGE CO - CAPAC	320.98
SAINT CLAIR	B6637	ST. CLAIR COMPRESSOR STATION	189.95
WASHTENAW	N3920	FREEDOM COMPRESSOR STATION	189.10
LIVINGSTON	N5590	HARTLAND PRODUCTION FACILITY	155.61
MACOMB	B6636	RAY COMPRESSOR STATION	75.04
MACOMB	N3391	ROMEO GAS PROCESSING PLANT	58.54
SAINT CLAIR	B6480	COLUMBUS COMPRESSOR STATION	52.75
WAYNE	B2158	BUCKEYE TERMINALS, LLC - WOODHAVEN	52.50
MACOMB	B8337	MUTTONVILLE COMPRESSOR STATION	50.59
		Industrial/Commercial/Institutional Boilers	
WAYNE	A7809	U S STEEL GREAT LAKES WORKS	3,041.27
WAYNE	M4148	GREATER DETROIT RESOURCE RECOVERY	786.74
WAYNE	A9831	MARATHON PETROLEUM COMPANY LLC	463.13
WAYNE	N6631	DEARBORN INDUSTRIAL GENERATION	379.89
WAYNE	M4199	GENERAL MOTORS HAMTRAMCK	367.16
SAINT CLAIR	B6420	E.B. EDDY PAPER INC.	364.45
WASHTENAW	M0675	UNIVERSITY OF MICHIGAN	284.96
SAINT CLAIR	A6240	CARGILL SALT INC.	232.17
OAKLAND	N1436	CHRYSLER TECHNOLOGY CENTER	206.21
OAKLAND	B7227	GENERAL MOTORS - ORION ASSEMBLY	168.77
WAYNE	B2814	DETROIT THERMAL BEACON HEATING PLANT	164.39
LIVINGSTON	N5590	HARTLAND PRODUCTION FACILITY	155.61
MACOMB	B4049	GM TECHNICAL CENTER	149.62
WAYNE	M4734	FORD MOTOR CO AUTOTRANS NEW PROD	139.26
WAYNE	B2185	DETROIT PUBLIC LIGHTING DEPARTMENT	119.97
WAYNE	A8650	FORD MOTOR CO/ WAYNE COMPLEX	107.19
OAKLAND	B2329	PARKEDALE PHARMACEUTICALS, INC.	97.53
WAYNE	M4764	FORD MOTOR CO ELM STREET BOILERHOUSE	84.39
OAKLAND	B4031	GENERAL MOTORS - PONTIAC ASSY CENTER	80.85
WAYNE	M4782	EQ-BELLEVILLE	77.51
WAYNE	B2173	TAMINCO HIGHER AMINES, INC.	71.71
MACOMB	A3567	FORD MOTOR COMPANY - STERLING PLANT	71.15
WASHTENAW	B2052	GM POWERTRAIN GROUP WILLOW RUN PLANT	63.28
WAYNE	A8638	DETROIT DIESEL CORPORATION	55.51
WAYNE	B6230	FORD MOTOR CO RESEARCH &DEV CTR	54.13
WAYNE	B2158	BUCKEYE TERMINALS, LLC - WOODHAVEN	52.50
OAKLAND	G5067	WILLIAM BEAUMONT HOSPITAL	52.47
MACOMB	B2767	DAIMLERCHRYSLER AG, WARREN TRUCK	50.71

		Blast and Other Furnace Operations at Steel Mills	
WAYNE	A7809	U S STEEL GREAT LAKES WORKS	1,603.10
WAYNE	A8640	SEVERSTAL NORTH AMERICA, INC.	248.63
MONROE	B7061	MACSTEEL MONROE INC	118.52
		Kilns	
MONROE	B1743	HOLCIM (US) INC.	2,582.05
WAYNE	B2169	CARMEUSE LIME/ RIVER ROUGE	446.535
		Flares at Landfills	
WAYNE	N5986	CARLETON FARMS LANDFILL	170.10
MACOMB	N5984	PINE TREE ACRES, INC.	139.89
WASHTENAW	N2688	VEOLIA ARBOR HILLS LANDFILL	112.65
WAYNE	M4469	RIVERVIEW LAND PERSERVE	77.69

* Combined emissions from stationary sources greater than 50 tons per year.

11.3 SO_2 RACT-RACM Analysis

The MDEQ's SO_2 RACT analysis began by looking at the 2005 MAERS inventory for all reporting SO_2 stationary sources in the 7-county $PM_{2.5}$ nonattainment area. The total SO_2 emissions for these sources are greater than 245,000 tons/year. A cut-off of greater than 50 tons of SO_2 per year per source was used to isolate those sources that are most likely to be large enough to be impacted by a RACT control program. This grouping of larger sources represents the vast majority of stationary source SO_2 emissions, at approximately 244,000 tons/year.

This grouping of larger sources was then broken down by major source type, based on operations at each of the stationary sources. A breakdown of the source categories by size is as follows. The highest emitters are EGUs, with the next highest sources group being ICI boilers. The third highest source group was flares used to burn off gases at steel mill operations. The fourth highest was glass manufacturing operations. Building heaters were next, with casting operations at steel mills following closely. The remaining were miscellaneous sources. See Table 11.3.a.

It should be noted that source reporting to Michigan's emission inventory contained several groupings of units reported as "one" unit; therefore it is hard to determine the exact number of units at each stationary source. For example, a stationary source listed under ICI may have 6 boilers with aggregated emissions greater than 50 tons. SO_2 controls are on individual units and may not garner the predicted emission reductions as listed in Table 11.3.b.

EGUs
The EGUs are currently regulated under the CAIR and reductions will occur in conjunction with a regional trading program.

ICI Boilers
A review of LADCO's ICI Boiler workgroup presentations and a review of information submitted by the Energy and Environmental Analysis, Inc. to the Oak Ridge National Laboratory in May 2005 represented the most common ideas for RACT controls that would typically be used for ICI boilers. The most common for ICI boilers would be dry or wet scrubbers with a slight potential for in-duct injection.

Out of potential ICI sources within Southeast Michigan that could have SO_2 controls installed, none are currently controlled for SO_2. The anticipated level of emission reductions Michigan could obtain in the nonattainment area from affected sources are outlined in Table 11.3.b. Table 11.3.c. provides an assessment of SO_2 emissions sources that emit more than 50 tons per year in the Southeast Michigan's nonattainment area.

Regarding the ICI boilers, a workgroup consisting of the states in LADCO and Ozone Transport Commission and their respective regions are composing a request that the EPA create a national rule to achieve reductions for boilers greater than 50 mmBtu/hour heat input rates.

Kilns
There is one large stationary source with large kilns operating in the area. There is little potential for additional post-combustion SO_2 controls at this source. The current scrubber in operation at the site has an estimated 30-50 percent efficiency for SO_2 removal. Testing is currently being done at this site to determine a more accurate estimate. Once a determination is made, the MDEQ can then determine whether to require SO_2 controls at other smaller kilns in Southeast Michigan.

Glass Mfg.
The flat glass manufacturing operations could vent the SO_2 emissions to hoods and install the controls as listed in Table 11.3.b

Furnaces and Casting at Steel Mills
Furnaces and casting operations at the local steel mills could vent the SO_2 emissions to hoods and install the controls as listed in Table 11.3.b.

Table 11.3.a. SO_2 Tons and Percentages by Emission Source

Sources	SO_2 Emissions in Tons*	Percentage of Total Tons
EGUs	228,747	94
Kilns	7,381	3
ICI Boilers	4,336	1.6
Furnaces & Casting	3,144	1.2
Glass Mfg.	499	0.2
Totals	244,107	100

* Values are rounded

Table 11.3.b. Potential SO_2 Tons Removed

Cost Per Ton*	Percent Removed	Control Type	Tons of SO_2 Reduced			
			Kilns	Glass Mfg.	Furnaces & Casting	ICI
$965.00	90%	Dry Scrubber	NA	449	2,854	3,902
$750.00	95%	Wet Scrubber	NA	474	3,013	4,119

* Cost per ton values were based on EPA estimates as presented by Black & Veatch on December 2005

Table 11.3.c. SO_2 Emission Sources in Southeast Michigan*

County	SRN	Facility Name	SCC	SO_2 in tons
		Glass Mfg.		
MONROE	B1877	GUARDIAN INDUSTRIES	30501403	499.38
		Kilns		
MONROE	B1743	HOLCIM (US) INC.	30500706	7,227.00
WAYNE	B2169	CARMEUSE LIME/ RIVER ROUGE	30501618	154.92
		Furnace & Casting Operations		
WAYNE	A7809	U S STEEL GREAT LAKES WORKS	30390024	3144.180
		ICI Boilers		
ST. CLAIR	B6420	E.B. EDDY PAPER INC.	10200202	1355.620
WAYNE	A7809	U S STEEL GREAT LAKES WORKS	10200707	1094.877
WAYNE	A6240	CARGILL SALT INC.	10100204	598.038
WAYNE	N6631	DEARBORN INDUSTRIAL GENERATION	10200704	511.23
WAYNE	M4199	GENERAL MOTORS HAMTRAMCK	10200204	333.010
WAYNE	A8640	SEVERSTAL NORTH AMERICA, INC.	10200704	324.817
WAYNE	B7227	GENERAL MOTORS - ORION ASSEMBLY	10200204	118.514

* Combined emissions from stationary sources greater than 50 tons per year.

11.4 $PM_{2.5}$ RACT-RACM Analysis

The MDEQ's primary $PM_{2.5}$ RACT analysis began by looking at the 2005 MAERS inventory for all reporting primary $PM_{2.5}$ stationary sources in the 7-county $PM_{2.5}$

nonattainment area. The total primary $PM_{2.5}$ emissions for these sources are greater than 2,250 tons/year. A cut-off of greater than 15 tons of primary $PM_{2.5}$ per year per source was used to isolate those sources that are most likely to be large enough to be impacted by a RACT control program. This grouping of larger sources represents the vast majority of stationary source primary $PM_{2.5}$ emissions, at approximately 1,870 tons/year.

This grouping of larger sources was then broken down by major source type, based on operations at each of the stationary sources. A breakdown of the source categories by size is as follows. The highest emitters are EGUs with the next highest group being metal production. The third highest was mineral production, and the fourth highest was ICI boilers (see Table 11.4.a). Table 11.4.b shows the individual emission units greater than 15 tons and their current controls.

EGUs

The EGUs are currently regulated under Michigan's Rule R.336.1331 (Rule 331) and currently have an ESP or baghouse for $PM_{2.5}$ control. Also, several EGUs will be replacing ESPs with baghouses to comply with the MDEQ's proposed mercury rules.

Metal Production

All of the larger sources are or will be controlled for $PM_{2.5}$ using capture hoods, baghouses and ESPs. The RTI (2006) report indicated several other sources of $PM_{2.5}$ emissions, but most of these are minor sources (less than 15 tons/year emissions). (See Table 11.4.b for the individual emission units and their controls.)

Mineral Production

For the mineral production facilities, nearly 20 tons are controlled by a baghouse; however, the remaining 300 tons are uncontrolled. These operations could vent the emissions to hoods and possibly install a baghouse or ESP. However, based on information in AirControlNET (ver. 4.1), no $PM_{2.5}$ controls are suggested for glass furnaces.

ICI Boilers

For the ICI boilers, 55 tons of the 89 tons are controlled. The emissions unit at U.S. Steel is actually a reporting group of 5 boilers. Each individual boiler emits less than 15 tons; therefore controlling these sources would not create enough reductions to be beneficial and would create undue costs to the facilities.

Based on the small amount of potential reductions from primary $PM_{2.5}$ within the nonattainment area due to the large number of sources that are already controlled, additional controls are not likely to be considered RACT in the $PM_{2.5}$ nonattainment area.

Table 11.4.a. $PM_{2.5}$ Tons and Percentages by Emission Source

Sources	$PM_{2.5}$ Emissions in Tons	Percentage of Tons
EGUs	841.66	44.9%
Metal Production	627.79	33.5%
Mineral Production	320.46	17.1%
ICI Boilers	84.17	4.5%
Totals	1874.08	100.0%

Table 11.4.b. Potential $PM_{2.5}$ Controls and Reductions Achieved

SRN	Sources	SCC	Emission Process Description	$PM_{2.5}$ in Tons	Controls
	Mineral Production				
B1877	GUARDIAN INDUSTRIES	30501403	FLAT GLASS: RAW MATERIAL FOR GLASS MELTING FURNACE	161.208	
B1877	GUARDIAN INDUSTRIES	30501403	FLAT GLASS: RAW MATERIAL FOR MELTING FURNACE	138.419	
B1743	HOLCIM (US) INC.	30500706	CEMENT KILNS	19.717	Baghouse
	Primary Metal Production				
A7809	U S STEEL GREAT LAKES WORKS	30300913	BOF - VESSELS - OXYGEN BLOWING	133.971	ESP
A8640	SEVERSTAL NORTH AMERICA, INC.	30300917	TAPPING: BOF	128.979	Baghouse
A7809	U S STEEL GREAT LAKES WORKS	30390024	BLAST FURNACE GAS TO FLARES	43.401	Flares
A8640	SEVERSTAL NORTH AMERICA, INC.	30300916	CHARGING: BOF	40.700	Baghouse
A7809	U S STEEL GREAT LAKES WORKS	30390004	BLAST FURNACE GAS TO BLAST FURNACE D STOVES	40.520	Baghouse
A7809	U S STEEL GREAT LAKES WORKS	30390004	BLAST FURNACE GAS TO BLAST FURNACE B STOVES	34.711	Baghouse
A7809	U S STEEL GREAT LAKES WORKS	30300304	COKE QUENCHING	34.364	Baghouse and quench tower
A7809	U S STEEL GREAT LAKES WORKS	30300917	BOF - VESSELS - TAPPING	28.164	Baghouse
A8640	SEVERSTAL NORTH AMERICA, INC.	30300825	"C" BLAST FURNACE CASTHOUSE	27.115	Baghouse
A8640	SEVERSTAL NORTH AMERICA, INC.	30300825	"B" BLAST FURNACE CASTHOUSE	16.716	Baghouse in 2008
	ICI Boilers				
A6240	CARGILL SALT INC.	10100204	SPREAD STOKER COAL FIRED BOILER	55.470	Baghouse and cyclone
A7809	U S STEEL GREAT LAKES WORKS	10200704	NO 2 BOILER HOUSE BOILERS (ALL 5) BF GAS USE	17.630	
B2032	MARYSVILLE NPDC	10200602	NATURAL GAS OVEN FOR E-COAT LINE (EUECOAT)	15.908	

12. Reasonable Further Progress (RFP) Requirements

Rule 40 CFR, Part 51.1009 requires a demonstration of RFP. However, if the state submits an attainment demonstration showing attainment by 2010, the state is not required to submit a separate RFP plan. Through the weight of evidence demonstration in the SIP, Michigan has demonstrated that attainment of the $PM_{2.5}$ annual standard will be achieved by 2010. Therefore a separate RFP plan is not required to be part of this SIP submittal.

13. Contingency Measures

Rule 40 CFR, Part 51.1012 requires that the state must submit in each attainment plan specific contingency measures to be undertaken if the area fails to make reasonable further progress, or fails to attain the $PM_{2.5}$ NAAQS by its attainment date.

Michigan is using a two-tier approach for the contingency measures. The first tier contains measures that are very likely to occur. The state is actively pursuing these rules or permits with companies in the nonattainment area. The second tier contains additional measures that need further investigation. The options in the second tier will be a starting point for evaluations of future controls in the event attainment does not occur in 2010 as predicted in this SIP. It will also be considered for controls needed for the new 24 hour $PM_{2.5}$ NAAQS. The list of contingency measures is shown in Table 13.a.

13.1 Tier I

1) State Mercury Rules.
   All EGUs in the state will be required to comply with a 90 percent mercury reduction using activated carbon injection, which requires a baghouse (many EGUs in the state have ESPs and will have to upgrade) or do multi-pollutant controls of 75 percent mercury reductions, 95 percent NOx reductions and 90 percent SO_2 reductions.

2) ICI boilers.
   Michigan is working with other LADCO states, as well as the Northeast states, to develop a national rule for ICI boilers that they will propose to the EPA.

3) Clean diesel projects.
   Michigan is applying for federal grants to retrofit additional school buses and possibly some municipal bus fleets in the Detroit area.

4) Street sweeping.
   The Marathon Petroleum Company is proposing in a permit to sweep several streets in the vicinity of the Marathon Plant and near the Dearborn monitor.

13.2 Tier II

The primary source of information the MDEQ used in developing the following list of potential contingency measures was the steel mill report developed by RTI (2006). The report provided information on areas for possible additional control at the facilities which directly impact the monitor showing nonattainment of the $PM_{2.5}$ standard. In addition, control options from NACAA, EPA, and various web sites were evaluated and included in the contingency list. Furthermore, the RACT evaluations for NOx, SO_2, and primary $PM_{2.5}$ indicated a few possible measures for control. The list of contingency measures with associated data is shown in Table 13.a.

1) Steel Mill Operations.
   a) EES Coke battery controls.
      Require additional SO_2 controls by adding on a desulfurization unit.
   b) Process heater and boilers.
      Require additional SOx and NOx controls on various operation process heaters and boilers.
   c) Casting operations.
      Require additional NOx controls on the hot strip mill processing at the steel facilities, such as Low NOx burners and SNCR. Emissions reported for these operations are 500+ tons from Severstal and 300+ tons from the U.S. Steel.
   d) Torpedo Cars.
      Require covers or cars to be filled before transporting, to reduce smoking. Continue studying options to reduce emissions from this source.
   e) Slag Pits.
      Require additional controls on the slag pits at the steel facilities. Suggested controls include water suppression, capture hoods or operations and baghouses.
   f) Capture hoods.
      Install or upgrade capture hoods for various processes at the steel mills, such as the kish pile.

2) Reciprocating Internal Combustion (RIC) Engines.
   Lower the threshold limit of NOx emissions in the current rule for RIC engines requiring controls.

3) Outdoor Wood Burners.
   Require performance standards on outdoor wood burner manufacturers. Emissions estimated at 8000 tons/year of fine particulate in Michigan with 90 percent emitted from November through March.

4) Flat Glass Melting Furnace.
   Require NOx, SO_2 and primary $PM_{2.5}$ controls. NOx controls such as low NOx burners, SCR, and SNCR can reduce emission from 40 to 75 percent (AirControlNET, 2005). However, EPA does not have suggested controls for SO_2 or $PM_{2.5}$ for this type of facility.

5) Charbroiling operations at restaurants.
   a) Require installation of catalytic oxidizer for conveyorized charbroilers at commercial cooking establishments, reducing $PM_{2.5}$ source emissions by 85 percent. Other eastern states and California already have these requirements.
   b) Require installation of an ESP (smog-hog) or scrubber on underfired char-boilers at restaurants, reducing $PM_{2.5}$ source emissions by 99 percent.

6) Paved roads and unpaved lots.

   Fugitive dust from paved roads and unpaved lots is a potential source of $PM_{2.5}$. Further evaluation of potential reductions in $PM_{2.5}$ from these sources will be pursued. Detailed cost and emission reduction information specific to these sources in the high $PM_{2.5}$ area in Southeast Michigan is not available and therefore not listed in Table 13.a.

Source or Category	Control Options	Expected Emission Reduction	Time needed for legislation/ rule	Time needed for implementation	Comments
Tier I—Controls likely to happen					
Mercury Rule for EGUs	Activated carbon injection (requires a baghouse)	90% mercury reduction	Working on rule, may be in place by end of 2008	Beginning January 2015	
	Multipollutant strategy:	75% mercury, 95% NOx and 90% SO_2 reductions			
Federal ICI boiler rule	Wet or Dry Scrubbers	30 to 85% reductions in SO_2	12-18 months	< 6 month after rules promulgated	Multi-regional workgroup to request EPA promulgate federal regulations.
	SCR, SNCR or low NOx Burners	30 to 80% reduction in NOx			
Clean Diesel projects	Retrofit additional school buses and possibly some municipal bus fleets		Not Applicable	< 6 months	Currently applying for federal grants
Street sweeping	Marathon is proposing to sweep several streets in the vicinity of the Dearborn monitor		Not Applicable	< 6 months	Part of permit to install application #388-07
Tier II—Potential Contingency Measures					
SO_2 controls on EES Coke Battery	Install a desulfurization unit on the coke battery.	90% reduction of SOx emissions[1]	12-18 months	< 6 months after rules promulgated	Suggested in RTI (2006) report.
NOx controls for process furnaces and boilers at Steel mills	Low NOx burners, ultra low NOx burners, SNCR, SCR, flue gas recirculation, or a combination of NOx controls	40-97% reduction[1]	12-18 months	< 6 months after rules promulgated	Suggested in RTI (2006) report.
Slag pits at steel mills	Incorporate techniques to reduce emissions, such as wet suppression or an enclosure and baghouse		12-18 months	< 6 months after rules promulgated	Suggested by MDEQ permit engineers and inspector.
Torpedo cars at steel mills	Require covers to reduce smoking		Not Applicable	< 6 months	Based on MDEQ AQD consent order #6-2006

Upgrade/install hoods for processes at steel mills	Improve capture efficiencies (e.g., kish pile at Severstal)		12-18 months	< 6 months after rules promulgated	Suggested in RTI (2006) report and by MDEQ inspector.
SO_2 controls for boilers and process heaters at steel mills	Advanced, wet or dry flue gas desulfurization	90-99% SO_2 removal[1]	12-18 months	< 6 months after rules promulgated	Suggested in RTI (2006) report and by RACT/RACM evaluation.
Casting operations at steel mills	Add SO_2 controls for casting operations	90-95% SO_2 removal, potentially 1680-1770 tons reduced[3]	12-18 months	< 6 months after rules promulgated	Possible sources indicated by RACT/RACM evaluation.
NOx controls on RIC engines	Lower the threshold limit in current State rule	50-80% NOx control, 1188-1901 tons reduced[3]	12-18 months	< 6 months after rules promulgated	Possible sources indicated by RACT/RACM evaluation.
Outdoor wood burners	Required performance standards: outdoor wood burners for new units		12-18 months	< 6 months after rules promulgated	Few sources in nonattainment area
Flat glass melting furnace	Require controls for SO_2, NOx, and primary $PM_{2.5}$	10-85% NOx control, \$700-\$2320/ton[4]	12-18 months	< 6 months after rules promulgated	No controls are suggested for SO_2 or $PM_{2.5}$ for this source[4]
Commercial cooking-conveyorized charbroiler	Catalytic oxidizer	83% $PM_{2.5}$ control, \$3000/ton [2]	12-18 months	< 6 months after rules promulgated	
Commercial cooking-large underfired grilling	ESP (Smog-hog) or scrubber	99% $PM_{2.5}$ control, \$6000/ton [2]	12-18 months	< 6 months after rules promulgated	

[1] RTI report (2006)
[2] EPA Lists of Potential Control Measures for $PM_{2.5}$ and Precursors
[3] Based on EPA estimates as presented by Black and Veatch, December 2005
[4] AirControlNET, ver 4.1, September 2005

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